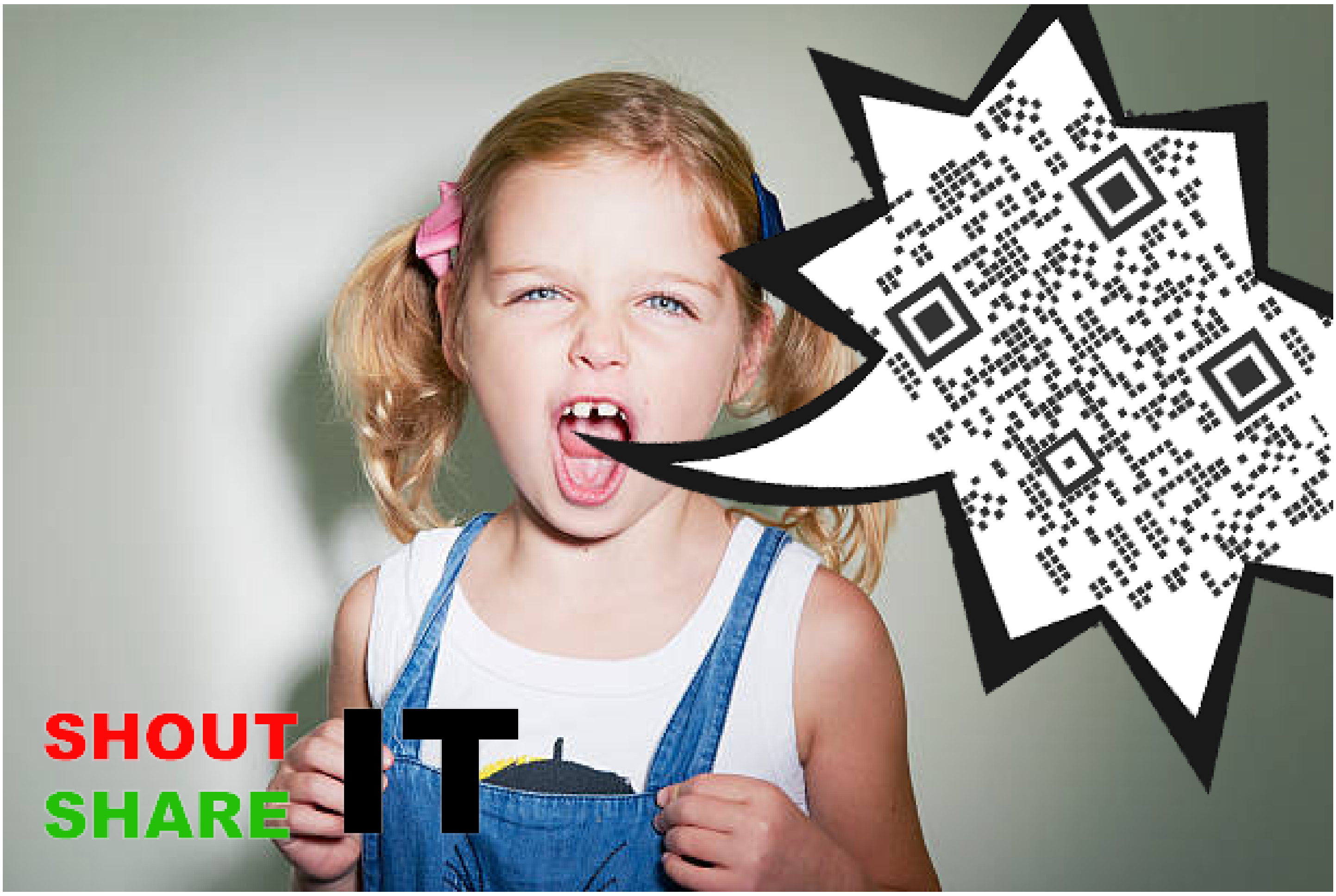
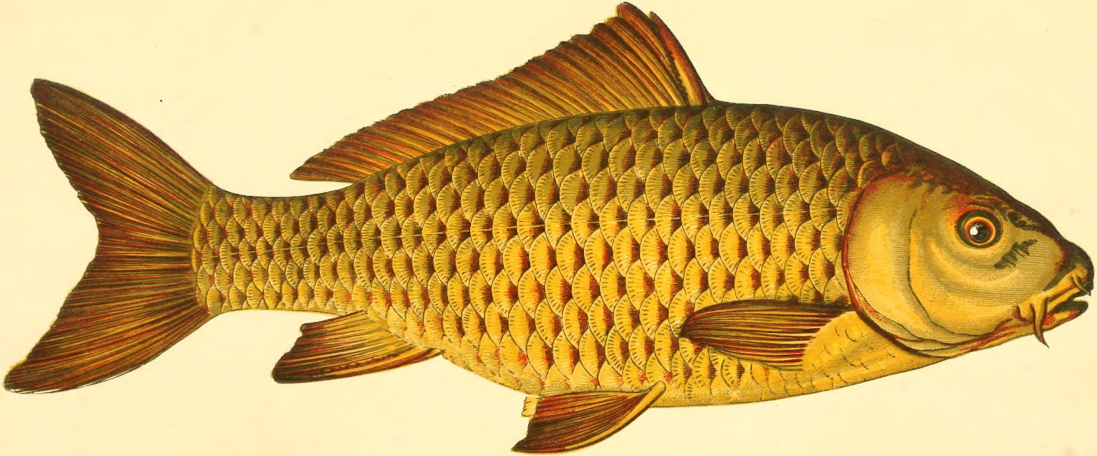

SHOUT
SHARE
IT

Div. Fishes. Cardell

1976 ✓



CARP.

CLXXX

QL
633
G7C8X
1862
v.4
FISH

A

HISTORY

OF THE

FISHES

OF THE

BRITISH ISLANDS.

BY JONATHAN COUCH, F.L.S.

VOL. IV.

CONTAINING SEVENTY-THREE COLOURED PLATES,
FROM DRAWINGS BY THE AUTHOR.

> The works of the LORD are great, sought out of all them that have pleasure therein.—PSALM cxi, v. 2.

LONDON:
GROOMBRIDGE AND SONS, 5, PATERNOSTER ROW.
M DCCC LXIX.

SMITHSONIAN
LIBRARY

LIBRARY

CANCELLED
CANCELLED
LIBRARY
PHILADA.

CONTENTS.

PAGE.
Carp 4
Barbel 16
Gudgeon 20
Tench 22
Crucian 28
Prussian Carp 31
Goldfish 33
Lake Bream 36
White Bream 40
Pomeranian Bream 42
Chub 44
Roach 47
Rudd 49
Dobule 51
Dace 54
Bleak 56
Graining 59
Azurine 61
Ide 63
Minnow 64
Loach 69
Spined Loach 72
Sheatfish 74
Pilchard 79
Herring 95
Leach's Herring. (No Plate) 107
Sprat 109
Sardine. (No Plate) 112
Whitebait 114
Allis Shad 117
Twait Shad 122
Scale-finned Shad 123
Great-headed Sprat. (No Plate) 124
Anchovy 125
Greater Flying Fish 128
European Halfbeak 135
Blunt-headed Halfbeak 139
Skipper 141
Garfish 146
Pike 150
Salmon 163
Peal 200
Sewen 208
Sea Trout 211
Salmon Trout 214
Slender Salmon 216
Blue Poll 219

PAGE.
Lake Trout 222
Common Trout 225
Gillaroo 240
Lochleven Trout 243
Samlet, or Parr 245
Willoughby's Char 262
Torgoch of Llanberris 264
Gray's Char 267
Cole's Char 269
Alpine Char 272
Smelt 276
Grayling 280
Guiniad 286
Vendace 289
Pollan 292
Powan 295
Hebridal Smelt 297
Argentine 301
Sharp-nosed Eel 326
Dublin Eel 328
Broad-nosed Eel 330
Snig Eel. (No Plate) 331
Ophidium Eel 333
Muræna 335
Conger 340
Morris 348
Greater Pipefish 351
Broad-nosed Pipefish 355
Ocean Pipefish 356
Snake Pipefish 359
Worm Pipefish 361
Straight-nosed Pipefish 363
Hippocampus 364
Four-horned Trunkfish 366
Filefish 369
Pennant's Globefish 373
Sunfish 377
Longer Sunfish 381
Sea Lamprey 385
Lampern 395
Silver Lamprey 400
Planer's Lamprey 402
Mud Lamprey 404
Borer 408
Lancelet 415

APPENDIX.

Broad-headed Gazer 421
Long-finned Grey or Golden Mullet 421
Garfish. (No Plate) 422
Sciæna 423
Short-finned Tunny 425
Silvery Gade. (No Plate) 427

FISHES OF THE BRITISH ISLANDS.

CYPRINIDÆ.

THE CARP FAMILY.

This family, says Cuvier, is recognised by the mouth being slightly cleft, with jaws in most instances without teeth, and its border formed by the maxillary bones: the gullet furnished with strong teeth: rays of the gill-membrane very few in number. The body is covered with scales, and there is no adipose fin on the back: ventral fins on the abdominal line.

The character assigned by Artedi is, that there are three rays in the gill-membrane; mouth altogether smooth, and in the gullet two hard saw-like bones on the lower part, and above a single oval bone not so hard as the others, these bones supplying the place of teeth. The air-bladder is constricted in the middle as if tied with a cord; to which we may add that from the hindmost chamber of this bladder is directed forward a duct to be united to the gullet, or perhaps to the brain. Abdominal fishes.

The bones of the gullet here referred to are in some degree equivalent to the beds of teeth in the posterior portion of the mouth in many other species; and some other kinds not closely allied to the *Cyprinidæ* have somewhat similar beds, as especially the family of Wrasses. But in the *Cyprinidæ*, as they appear to exercise a special office, somewhat answering to rumination, as in addition to their situation near the entrance of the stomach, their construction is more prominent and strong; and they are fixed on a firm bone of a crooked shape, which gives them a firm and defined motion, in which they act by powerful muscles. In fact it appears certain that a real action of rumination takes place in these fishes, although they do not possess a complication of stomachs as in quadrupeds of the ruminating order; as indeed rumination seems to take place in some of them, in which the stomach is of the more simple form. Professor Owen remarks that the muscular action of a fish's stomach consists of vermicular contraction, creeping slowly in succession from the upper orifice to the lower, and impressing a two-fold gyratory motion on the contents; so that while some portions are proceeding to the lower, other portions are returning towards the upper; but only portions of digested food are permitted to pass into the intestine. Coarser portions of the food return into the gullet, and are brought again within the sphere of the pharyngeal jaws. The fishes which afford the best evidence of this ruminating action are the *Cyprinoids*—Carp, Tench, Bream. In them the successive regurgitations of the contents of the stomach produce actions of the pharyngeal jaws as the half-bruised food comes into contact with them, and excite the singular tumefaction and subsidence of the irritable palate, often termed the tongue, as portions of the regurgitated food are pressed upon it.

The species of this family which are inhabitants of the warmer portions of the world, and especially those which are described by Mr. Maclellan, as found in India, (in the second part of the nineteenth volume of "Asiatic Researches,") are very numerous; and so closely are they joined together in affinity of form and habits that much difficulty has been experienced in arranging them in lesser sections or genera. In doing this, Cuvier appears to lay much stress on the length or shortness of the single dorsal fin, or on its situation forward or behind; and in a less degree on the presence or absence of barbels at the mouth, which are organs we might suppose to be of importance, as being fitted to some particular habits in these fishes, as we know them to be in the family of Codfishes. Mr. Maclellan remarks on this subject, that in none of the Barbels, Cirrhins, or Gudgeons, nor in any of the groups which feed on plants, shell-fish, or other objects obtained by scraping or rooting in mud, do we find anything like a soft or sensible tongue, the office of which is in many cases better performed by the barbs; which organs are soft and capable of being contracted or lengthened, as well as the loose muscular appendages to which they are attached.

As it appears from an extended survey of the Carp family, that a separation into genera on the grounds here referred to would divide asunder some species which in other characters appear to be closely united, it has been proposed to form the separation according to the length or shortness of the alimentary canal, which organ varies in the proportion as the food is found to be vegetable or animal, in the former case the entrails being convoluted, and of considerable length, while in the latter they are short and straight. But to an arrangement formed on these relative proportions it may be objected, that probably in no instance is the food exclusively vegetable or animal, and consequently the absolute length of the intestine will not be found so definite in the separate species as to afford a sufficient means of distinction; to which we may add, that a doubtful example or new species must be dissected or mutilated before its place in the family can be ascertained; and if preserved in a museum, its supposed generic character will be altogether lost sight of.

It may happen, however, that a division of the species, which is built on principles that might be objected to when applied to the whole of this extensive family, shall still be appropriate to the comparatively few which we find in British waters; and accordingly, we so far adopt the arrangement of Cuvier, as to place in his genus *Cyprinus,* those of the British species which he has comprised within it, and which are marked by the possession of barbs at the mouth; while the others that do not possess these appendages are classed in other divisions.

CARP.

Carp,	JONSTON; Titulus 3, Caput 6.
"	WILLOUGHBY; p. 245, table 2.
Cyprinus Carpio,	LINNÆUS. CUVIER. BLOCH; pl. 16.
" "	DONOVAN; pl. 110. JENYNS; Manual, p. 401.
" "	FLEMING; Br. Animals, p. 185.
" "	YARRELL; Br. Fishes, vol. i, p. 349.

THIS species, with all others of this family, inhabits fresh water, in which its haunts are in lakes or ponds, or slowly-flowing rivers; where, in common with the other British species, it is decidedly influenced by the cold of winter, at which season they seek to withdraw into shelter and concealment, where sometimes they even seem to become torpid, yet as not to be killed even by becoming frozen, and from which condition they are restored as warmth returns to the air. Whether the reference is to the same species we are not able to say; but Captain (Sir John) Franklin says in the history of his first voyage to the Polar Sea, that the fish caught in their nets became so frozen that in a short time they formed a solid mass of ice; and by a blow or two of the hatchet they were easily split open, so that their entrails might be removed in one lump. But if in this frozen state they were thawed before the fire they recovered their animation. This was particularly the case with the Carp; and he has seen a Carp so completely restored after having been frozen for thirty-six hours, as to leap about with much vigour.

As a contrast to this it is proper to adduce the experiments of John Hunter, which he made with two Carps, placed in a glass vessel with river water, and subjected to a freezing mixture made of ice and snow with muriate of ammonia, by which the temperature was reduced to 10°, and perhaps below it. In this condition the vital heat of the Carp was sufficient to melt the snow, for several times in succession that it was applied; so that at last the whole was exposed to the action of the natural cold of the air without; and while subjected to this low temperature the fish showed signs of great uneasiness. It was only when they had exhausted their powers of life in the production of heat that these Carps became frozen, and perhaps were dead; for when again gradually thawed they were not recovered to life. If we are to suppose that the fish frozen by Sir John Franklin were of the same species as those of Hunter, the only explanation of this difference of result will be that the suddenness of the operation in the north prevented that exhaustion of vitality which was fatal in the other.

Nor are these the only circumstances under which it shews itself highly retentive of life; for in districts where this fish abounds it has been usual to convey it to market in a living state, and if not sold it is again returned to its resting place; which may be in some cool cellar, and that for days or even weeks together; the only caution used being to preserve the surface of the body in a moist condition, and to feed it with some necessary food; by which it has been known to become plump and fat. Willoughby remarks that this fish has sometimes been found in such strange situations as to convey the impression that it could not have been placed there by any known means; and this has been thought sufficient to countenance the idea that the individuals had been produced by spontaneous generation.

The retentiveness of life thus possessed by the Carp is the more remarkable, as it is not furnished with such a mechanical adaptation for retaining water in contact with the gills, as exists in some fishes; but Professor Owen supposes that this apparent deficiency may find more than a conpensation in a peculiar development of the vagal lobes of nerves, which arise from the lengthened process of the brain, termed *Medulla oblongata*. This character is more or less displayed in some others of this family, and especially in the Tench; and it may be that thus they are enabled to extract and subsist on almost the minutest portion of air which remains mixed with water after the larger part has been absorbed into the blood; and in this faculty they exceed almost all other kinds of fishes.

That the Carp is also naturally long lived there are sufficient proofs, and Gesner mentions an instance where one was believed to have attained to an hundred years; but even this is said to have been considerably exceeded in some instances, although on evidence that may be considered doubtful.

There is reason for supposing that the Carp was not originally a native of Britain; and its power of living long out of water renders its highly probable that it may have been brought to this country, as we know it has been conveyed to others, from very distant places. But on the other hand, Leonard Mascal affirms that it was himself who introduced it in the reign of Henry the Eighth; which boast could only shew that he had conveyed it to places where it was not before known; for it is referred to as a known, although not common, fish in the Book of St. Albans, a portion at least of which is believed to have been written or compiled by Dame Juliana Berners, and the fishing portion of which was printed with the rest by Wynkyn de Worde towards the end of the fifteenth century. It is not unreasonable to believe that we owe the possession of this fish in the first place to the sagacious industry of monks, who were acquainted with it as a pleasing addition to their table, and a variation from the more common of the inhabitants of our streams.

It is believed to have been introduced into Ireland still more recently than into England, and its progress from place to place in all cases has been slow; so that it is only in recent times it has obtained a residence in the extreme west of England; which circumstance however, may be explained by the fact that there are there no slow-moving rivers to suit its habits; and the cost of forming a pond, which is essential to its preservation, is unnecessary, in consequence of the abundance of the fish of the sea so easily procured.

That these ponds were regarded as important in the economy of noble and gentle houses in inland situations, at a time when a fish diet formed a portion of the religion of all orders of society, appears from a variety of authorities in the domestic history of our country; and much expense was employed in forming them, while severe laws were enacted to keep them safe from such as sought to observe the ritual at the expense of their honesty, or who may have coveted delicacies of which they grudged the possession to their superiors.

The value formerly set on these ponds is shewn by the fact that at so early a date as the twentieth year of Henry the Third, (who was declared of age in the year 1222,) in consequence of their being so often plundered, the lords demanded of the king the imprisonment of such as trespassed on these waters or the parks, but without making any reference to rivers; in which latter we may suppose the more native fishes would be found. But the law then made availed but little; for we find again in the third year of Edward the First, who was crowned in the year 1274, that punishment was decreed on such as trespassed on parks and ponds; and although it will be admitted that there are other valuable fishes, as the Tench, preserved in these ponds, yet, coupled with the authority of the Book of St. Albans, we are inclined to believe that the principal object of these thieves was to obtain this otherwise unattainable fish; for the rivers, which are not mentioned in the laws then made, were not in general at that time specially protected or forbidden to the public, and would have afforded the more common sorts in abundance; and yet, the value set on the Carp as a luxury appears to rest much on the manner in which it was prepared for the table; with which also fashion must have had much to do. Izaac Walton informs us that it was cooked with wine, spices, and strong ingredients, by which its native taste was disguised, or its soft and watery inanity overcome. But the more favoured luxury was its characteristic palate, or, as fashion chose to term it, the tongue, of which the cost must have been the chief recommendation. I possess a note written at the beginning of the last century by an observant gentleman, in which he says that in the month of June, at a dinner provided out of the proceeds of a wager, one dish consisted of the palates of Carps stewed; for which piece of elegancy forty-three brace of Carps were purchased. This dish appears indeed to have been of old standing, for it is alluded to, among other extravagances, by Ben Jonson:—

> "The togues of Carps, Dormice, and Camels' heels,
> Boiled in the spirit of Sol."

As it is sometimes found difficult even for the owner of a pond, when it is thickly grown with weeds, among which Carps seek refuge, to obtain these fish when he wants them, as is particularly the case when the wisdom of the fish has been increased by the experience of age, the following directions, extracted from Daniels' "Rural Sports," may be found useful:—"In May or early in June, which is the chief time of their spawning, and when they always resort to the weeds, let a green silk setting net, without leads, and only one float at each extremity, be dropped in the clear water, and drive with the wind to the outside edge of the weeds; then go in a boat through the weeds between the net and the shore; the Carp will fly at the noise to the deep water, and be taken with the net, on their entrance into it, and which from its colour the Carp does not discover in his haste to escape from the boat." We may suppose that a net of very fine twine of the proper tint, although not of silk, will be equally successful.

The formation of a pond is described by the Hon. Roger North, and is here given because it also conveys some portion of the history of the Carp, as it was then generally understood:—"It is the most valuable of all kinds of fish for stocking ponds, because of its quick growth and great increase. If the feeding and breeding of this fish were more understood and practised, the advantages resulting would be very great; and a fishpond would become as valuable an article as a garden. The sale of Carp makes a considerable part of the revenue of the principal nobility and gentry in Prussia, Pomerania, Brandenburg, Saxony, Mecklenburg, Bohemia, and Holstein. Particular attention should be paid to the soil, water, and situation of a Carp pond; the best kind are those which are surrounded by the finest pasture or corn-fields, with a rich black mould, and soft springs on the spot, or other running water that is neither too cold or impregnated with acid, calcareous, selenitic, or other feraneous, mineral particles. The water may be softened by exposing it to the air or sun in a reservoir, or by forming an open channel for it some distance from the pond; they should be exposed to the influence of the sun, and sheltered from the eastern and northerly winds.

"By experience it is found convenient to have three kinds of ponds for Carp, namely, the spawning pond, the nursery, and the main pond; the first pond must be cleared of all other kind of fish, especially those of the rapacious kind, such as the perch, pike, eel, and trout, the water-beetle, and also of newts or lizards. It should be exposed to sun and air, and be supplied with soft water. A pond of one acre requires three or four male Carp, and six or eight female ones; and in the same proportion for each additional acre. The best Carp for breeding are those of five, six, or seven years old, in good health, with full scale and fine full eyes, and long body, without any blemish or wound; the pond should be stocked in a fine calm day, towards the end of March or beginning of April. Carp spawn in May, June, or July, according to the warmth of the season; and for this purpose they swim to a warm, shady, well-sheltered place, where they gently rub their bodies against the sandy ground, grass, or osiers; and by this pressure the spawn issues out at the spawning season. All sorts of fowl should be kept from the ponds; the young fry is hatched from the spawn by the genial influence of the sun, and should be left in this pond through the whole summer, and even the next winter, provided the pond is deep enough to prevent their suffocation during a hard winter; then the breeders and the fry are put into ponds safer for their wintering."

We suppose that this caution refers to the danger arising from the freezing over of the pond, by which the air would be excluded, and the fish below be in danger of suffocation. This would apply to all kinds of fishes; but Ælian particularly mentions fish which he terms Black Carps, and may have been the common species, if they were not the Tench, as being caught in the Danube, by gathering in multitudes at holes made in the ice, when that river has been frozen over.

The quotation we make proceeds:—"The second kind of ponds are the nurseries; the young fish should be moved in a fine calm day into this pond, in the month of March or April; a thousand or twelve hundred of this fry may be well accommodated in a pond of an acre. In two summers they will grow as much as to weigh four, five, or even six pounds, and be fleshy and well tasted. The main ponds are to put those into that measure a foot, head and tail inclusive; every square of fifteen feet is sufficient for one Carp; their growth depends on their room, and the quantity of food allowed them. The best season for stocking the main ponds are spring and autumn; Carp grow for many years, and become of considerable size and weight. Mr. Forster mentions seeing in Prussia two or three hundred Carps of two and three feet in length, and one five feet long and twenty-five pounds weight; it was supposed to be about sixty years old. These were tame, and would come to the side of the pond to be fed, and swallowed with ease a piece of bread half the size of a halfpenny loaf. There is reason to believe that these same fish remain to the present time.

"Ponds should be well supplied with water during the winter, and when they are covered with ice, holes should be opened every day for the admission of fresh air, through want of which Carps frequently perish. It is worthy of notice that although the Romans were at great pains and expense in the formation of ponds for various sorts of fish, none of the Carp family are mentioned as being preserved in them, although some of less estimation with us were then cared for; a proof of the little estimation in which the Carp and Tench were held by that luxurious people.

"Carp are sometimes fed during the colder seasons in a cellar; the fish is wrapped up in a quantity of wet moss laid on a piece of net, and then laid into a purse; but in such a manner, however, to admit of the fish breathing; the net is then plunged into water, and hung to the ceiling of the cellar. The dipping must be at first repeated every three or four hours, but afterwards it need be plunged into the water only once in six or seven hours; bread soaked in milk is sometimes given him in small quantities; in a short time the fish will bear more, and grow fat by this treatment. Many have been kept alive, breathing nothing but air in this way, several successive days."

It is a portion of the œconomic history of this fish to record the curious fact, that it has been castrated for the purpose of rendering it a more delicious morsel. The following is from the "History of the Royal Academy of Sciences at Paris," as copied into the "Gentleman's Magazine:"—"Sir Hans Sloane wrote to Mons. Geoffroy of this Academy, and F.R.S. of London, that a certain stranger came to communicate to him a secret he had found out of castrating fish, and fattening them by that means. This person, by the great skill he had acquired in distinguishing and breeding fish, was now able to make a considerable merchandise of them. The singularity of the fact excited the curiosity of this learned naturalist, and the fish merchant offered to give him ocular proof of the same. Accordingly he procured eight Carrushens, (a kind of small

Carp lately brought into England from Hamburg, and which, beyond doubt, is the *Cyprinus carassius* of Linnæus.) These were put into two large bladders filled with water, which had been shifted once or twice upon the road. He presently cut open one of these Carps in Sir Hans's presence, and shewed him the ovary, with its canal leading into the part called the cloaca. He then performed the operation of castration upon a second by opening the ovary, and filling up the wound with the scrapings of a black hat. The castrated Carp, being put into water with six live ones, seemed somewhat less brisk as to swimming than they. Then they were conveyed all together into a basin of Sir Hans's garden, where the water is furnished from the neighbouring river, and he believed they were all alive when he wrote to M. Geoffroy. Mr. Tull, for that is the name of the person, promised Sir Hans Sloane a taste of such castrated fish the ensuing spring, assuring him that they as much excel all others in delicacy of relish as a capon does a cock, or a fat ox a bull. Mr. Tull has since castrated many thousands of fish for several of our nobility, to their entire satisfaction."

The food of the Carp is occasionally worms and insects, and it has even been known to devour small fishes, although this is only recorded of young individuals, and under confinement. A Carp between five and six inches in length was seen by Mr. Gurney to devour three young Minnows, each about an inch and a half in length, as they were confined with it in the same tank.—"Zoologist," 1860. But its more usual and preferable sustenance is vegetable; and for the purpose of grinding this to a pulp it is provided with appropriate pharyngeal bones, answering in some degree to those which are found in the gullet of the Wrasses; and it is, as we have seen, the opinion of Professor Owen that the vegetable food is a second time subjected to their grinding action, in the same manner as we have hazarded the opinion that it is the case with the other family. From some unaccountable variation of appetite, the endeavour to catch this fish with angling is exceedingly uncertain; and in some others of its habits it is believed to possess a large degree of wisdom, as well in the manner by which it escapes from danger, as in submitting to become tame and familiar when it is safe to be so. Thus sings the poem of the anglers:—

> Fish have their various characters assign'd,
> Not more by form and colour than by mind.
> The wary Trout but few temptations hit;
> The Perch an idiot, and the Carp a wit.

And another writer informs us, as quoted by Daniel in his "Rural Sports,"—

> Of all the fish that swim the watery mead,
> Not one in cunning can the Carp exceed;

which latter portion of its character is displayed in that, when encircled by a net, if no crevice can be found through which to pass, it will lower itself into some channel which it forms in the bottom, that the net may pass over it; or if that cannot be, then it throws itself over the head-rope, much in the same manner as the Grey Mullet in like circumstances. And again:—

> Learn what of late my wondering eyes beheld
> Near the green margin of the war-famed Scheld;
> Thick with enormous Carp, I saw them roll,
> Called by a practised brother of the cowl.
> His well-known whistle they obeyed, they sped,
> In wallowing heaps and hope the promised bread.
> Carp shouldering Carp, th' injected morsel snap:—

And the intelligence thus ascribed to this fish is borne out by the great development of the brain, in connection also with peculiarities in the structure of the organs of perception. According to Professor Owen, the average proportion of the size of the brain to that of the body in fishes is one in three thousand; but in the Carp, according to Blumenbach, it amounts to one in five hundred; which is the same as is found in "half-reasoning" elephant; this extraordinary development in the Carp existing also in the portion of that centre of intelligence termed the prosencephalon, or which most nearly answers to the cerebrum or seat of understanding in the higher animals. And although the bulk of the brain taken alone may not afford a just criterion of the amount of understanding in any creature, since it is known that in the proportion as the nerves of sense are large compared with the brain, the particular feeling to which they are adapted predominates over understanding or reflection; yet when proportionate magnitude is added to peculiarity of structure, the former must be regarded as an important element in the display of the faculty of understanding. There is a peculiarity in the nerves, especially those of the senses, as of sight, taste, and hearing, in that neither of them can be taught to perform the functions of another; and there is presumptive proof that this remark may be extended to essential portions of the brain itself; and that it is in this the conscious identity of every creature resides, or from which it derives its existence, which therefore intrinsically constitutes the true distinction of species. If there be a time when the nature of any creature appears to be substantially changed, so that the fearful becomes bold, or the contrary, when hunger suspends the indulgence of its appetite, and the wanderer confines itself to one solitary spot, it is when by the temporary preponderance of one specific nervous energy the action of the others appears superseded; and this most frequently occurs at the season of procreation; at which time Pennant informs us that the cautious and cunning Carp becomes so simple as to suffer itself to be tickled, handled, and caught by any one who will attempt to do it.

But the outward senses of this fish, as well as its inward consciousness, are acutely alive to sensation; of which one set of instruments is the barbels at the mouth, which in some degree corresponds to what is also a character of the Cod family. The pad also in the roof of the mouth is elastic and highly sensitive, being furnished with a large number of nerves, which are derived from the eighth pair as they arise from the brain, and are peculiarly fitted to receive these impressions. That these fishes are brought together by sounds is a proof of the quickness of their hearing as well as of their knowledge of the object for which they are made to assemble; in which particular again they resemble the Mullets; and by dissection it is found that their organs of hearing are not a little complex; with some reference again to the air-bladder, which, unlike what is found in most other fishes, is double in the Carp, as well as in the Tench and some others of this family; and this doubling is formed by means of a constriction towards its upper portion; from the second division of which proceeds a tube, which passes upward. A series of small bones has been discovered to proceed from the true organ of hearing downward, by which it has been supposed that the elasticity of air in this bladder may assist in perception of particular sounds.

The Carp is exceedingly prolific, and the early growth of the young is rapid; but although capable of producing spawn in the third year, the magnitude this fish is capable of reaching is not attained for several years beyond this. On the continent of Europe it has been seen of the length of five or six feet, but nothing like this has been witnessed in Britain. Individuals which have been in possession of both milts and roe have been met with more frequently in this species than in any other fish; and there are individuals which are absolutely neutral, or destitute both of milt and roe. Nor is this the only remarkable irregularity of structure; for I am informed by Edmund T. Higgins, Esq., who has carefully studied these objects in various orders of fishes, that in the Carp the otolithes (bones of the ear) are not always alike on both sides; in fact that in some instances they are altogether wanting on one side. The position of these bones is also different from what is the case in other fishes; so that the bone termed the malleus is at a distance from another called incus, and it is serrated all round the border. These things are worthy of notice, since they have not hitherto been recorded.

That the Carp was known to the ancient Greeks, however little regarded, appears from Aristotle, who particularly mentions the fleshy pad in its palate, and the manner of its breeding, of which he says, "Pond and river fish begin to produce usually when five months old; (but knowing little of Trout, and nothing of the Salmon, he is partially in error when he adds, 'they all produce their spawn at the beginning of summer.') The females of these kinds never shed all their spawn nor the males their milt at once; but both sexes are always found to contain a portion of these parts. The Carp produces five or six times a year, under the influence of the stars."—B. 6.

The Carp was introduced into the south of Sweden in the year 1560; and, together with the Tench, Dace, Roach, and Goldfish, it has been conveyed into the Colony of Victoria, in Australia, by the Acclimation Society of that country; where they are likely to live and thrive.

Pennant records the remarkable instance that "on fishing a pond in Dorsetshire, great numbers of Carp were found, each with a frog mounted on it; the hind legs clinging to the back, the fore legs fixed in the corner of each eye of the fish," which were thin and greatly wasted.

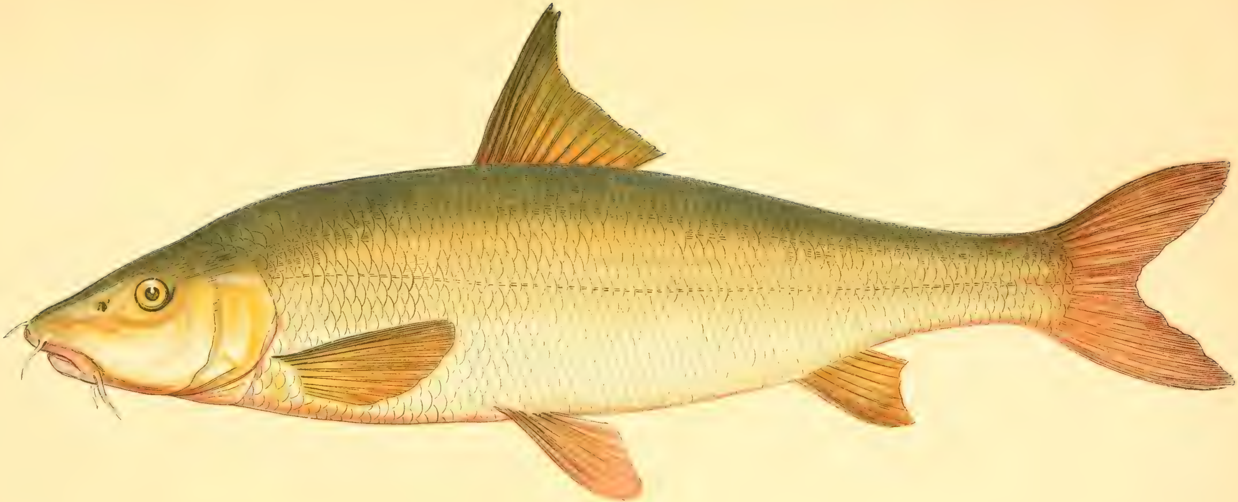
The example selected for description measured nineteen inches; the body stout and thick, sloping forward from the origin of the dorsal fin, but more suddenly from behind the head; the snout rounded; under jaw shortest; lips soft; no teeth in the jaw; a barb at each angle of the mouth, and a smaller one between the angle and the snout. Eye moderate; nostrils large, with a valve or cover; wide across the head, the body stout, belly full and round, sloping at the vent; scales large and well marked, the border of each with radiating lines. Dorsal fin single, beginning above the space where the pectoral ends, and continuing opposite the end of the much shorter but wide anal; the latter fin being wider than long. The first ray of both these fins short, the second long, stout, firm, toothed on the hindmost border. Pectorals low on the body, the upper four or five rays longest; ventrals separate, expanded; tail concave. The general colour is golden yellow, darker on the upper parts; roots of each scale brilliant brown.

According to Mr. Owen, the bones of fresh-water fishes are lighter than those of the sea; and although this does not hold good universally, another observation appears to do so; which is, that the most active fishes possess the lightest weight of bone, and the bones of the inactive Carp possess more density than those of the active Salmon.

BARBEL.

Barbus,	Jonston; B. 3, Tit. 1, C. 5, Table 26, f. 6, and Table 31, f. 11.
"	Willoughby; p. 259, Table Q 2.
Cyprinus Barbus,	Linnæus. Bloch; pl. 18. Donovan; pl. 29.
" "	Jenyns; Manual, p. 404.
Barbus vulgaris,	Cuvier. Fleming; Br. Animals, p. 185.
" *fluviatilis,*	Yarrell; Br. Fishes, vol. i, p. 367.

The Barbel has not a few of the habits of the Carp, and much that has been said of the structure of the organs of the senses and the faculties of the last-named fish, will also apply to the present species. The barbs at the mouth are even more developed than in the Carp, and the high condition of its organ of hearing has been shewn by its speedily quitting a place where much noise has been made. But its activity is greater than the Carp is capable of; as indeed might be judged from the more slender form of its body; and in the genial warmth of summer, when these fishes assemble in considerable troops, they delight to stem the course of the more rapid portion of the river they frequent, and more especially when night has set in they become lively, with an evident display of a love of sport. But it is otherwise when cold weather advances; on the occurrence of which they retire into the deeper and stiller portion of the stream, where the high banks afford them shelter; and there, in some secret pool, instead of being sly and watchful, they become so dull and stupid as to show no sensibility of danger, even to such a degree as to suffer themselves to be caught with the hand by any one who will attempt to do it. I have been informed that at Oxford they have been taken thus by diving; and the numbers sometimes huddled together in favourite situations may be judged from the fact, that Jonston refers to Albertus as a witness that in the Danube in autumn ten cart-loads have been caught with the hand at one time.



BARBEL.

LXXXI

The food of the Barbel is often vegetable, but it also feeds freely on worms, insects, or any molluscous animal or substance; in search of which it not only keeps near the bottom, as do the larger part of fishes which possess barbs at the mouth, but it will dig into the softer bottom of the stream. Anglers have taken advantage of this propensity by throwing into the still water some of their well-known soft and fat pastes, by way of attracting these fishes to the spot a few hours before the time they are prepared to fish for them. They may then be induced to take a bait freely, but when hooked they are not so readily brought to land. The Barbel is indeed, as the Book of St. Albans remarks of the Carp, "an evil fish to take; he is so strong enarmyd in the mouth that there may no weak harness hold him." Izaac Walton relates an instance where for several hours the fish refused to be landed, and at last made its escape; which, according to this writer, it does by running its head forcibly towards any covert or bank, and then striking the line with its tail; which action has the ancient authority of Plutarch.

We learn from the "Gentleman Angler," printed in 1726,—"The two famous places to angle for Barbel about London are at Kingston Bridge and Shepperton Pool; at the latter of which places there is great quantity of Barbel. No Barbel by the rules of angling ought to be killed which does not measure eighteen inches fairly. A Barbel taken in Byfleet or Weybridge Rivers, of twenty inches in length, will down weigh another of the same length taken in the Thames by a pound or upwards, and is much firmer, fatter, and better relished."

It spawns in the early part of summer not far from the bank of the river; and the spawn, which is discharged in a string, is entwined round some fixed object, as a stone or weed. Jonston refers to Albertus as saying, that the parents keep watch over the spawn after it is shed.

There is reason to believe that this fish is an original native of British lakes and the deeper rivers; but there are several counties in England and Scotland in which it is not found. In some others also it may have been introduced for the sake of variety; and it is not mentioned by Mr. Thompson among the fishes of Ireland, nor among those recorded in Scotland in the Royal Publication of the Natural History of Braemar and Deeside. It is not known in the northern portions of the continent of Europe, but it appears to be common in the south, although it finds no place in the ancient works of Greek and Roman writers. Ausonius alone among the last-named refers to it; but this he does in a slighting manner, as being (for the table,) best in the failing portion of its age. Yet there is some difference of opinion in this respect, and Dr. Badham, in his amusing book of fish-tattle, among others, speaks favourably of it; but this gentleman adds, that the precaution should be taken before cooking of removing the roe, as a very small fragment will produce serious internal derangement. This indeed was known at least so long since as the time of Gesner, if not referred to in the Book of St. Albans, and has been experienced since on numerous occasions, so that the rule regarding it should be to abstain; and yet it is reported to have been eaten sometimes with impunity. But as it is known that several symptoms of a choleraic kind have been occasioned by eating the generally wholesome roe of the Whiting, so it is probable that the generally unwholesome roe of the Barbel may occasionally be found safe. Life should not be risked in such a hazardous way; nor in another matter concerning this fish, regarding which we extract the following note from the already-quoted Book of St. Albans, in the quaint words and antique spelling of the writer:—"The Barbyll is a swete fysshe, but it is a quasy meete and a peryllous for mannys body. For comynly he yeuyth an introduxion to ye Febres. And yf he be eten rawe, he maye be cause of mannys dethe; whyche hath oft be seen."

The advice here given concerning the eating of raw fish will appear less strange when we refer to the custom of the Israelites in the time of Moses, of eating the flesh of the lamb in an uncooked condition; the indulgence in such a luxury being specially forbidden (Exodus, c. 12,) in the case of the lamb of the Passover. Again, in the book entitled "The Governayle of Helthe," printed by Caxton, are these lines:—

"For helthe of body cover for cold thy head,
Eat no raw meat, take good hede thereto."

But such a relative custom of our ancestors would not perhaps have been remembered but for this reference to it in the case of the Barbel; and yet with the light thus afforded to us, we believe we are able to trace it in another direction, and to the loftiest stations in the kingdom. In the "Pictorial History of England," (vol. ii, p. 254,) there are representations of a repast, in the reign of Edward the Third, where a fish is introduced, that I suppose to be a Perch; but in such a manner as if it were intended to be eaten raw. In one of these engravings a king is present; but only one of the company holds a knife. He seems to be the carver; and there is not a fork to be seen—that instrument being of much later invention. In our own day it has been the custon in the west of England to eat some kind of fish with the help of the fingers only,—the only plate being a piece of bread.

The usual length of this fish is about fifteen inches, but Mr. Jenyns assigns to it two and three feet. Where however the practice of fishing is so general, few individuals can escape so as to reach their utmost size. The form is moderately lengthened, rather narrow at the back, but not greatly compressed at the sides. Body clothed with scales of moderate size; lips fleshy, gape not wide, inferior, lower jaw shortest; no teeth, except the usual pharyngeal teeth of this family. A pair of conspicuous barbs above the upper lip, and one at each corner of the mouth, from which it obtains its name. Eye rather small. Lateral line along the middle of the side. Dorsal fin above the ventrals, at about the middle of the length, having ten rays, of which the second is the stoutest, and serrated; hindmost rays shortest. Anal fin narrow, with seven rays. Tail forked. Colour on the back greenish brown, or bluish; the sides inclined to yellow, below white. Eye yellow; dorsal fin brown tinged with red, as is the tail; anal fin and ventrals reddish.

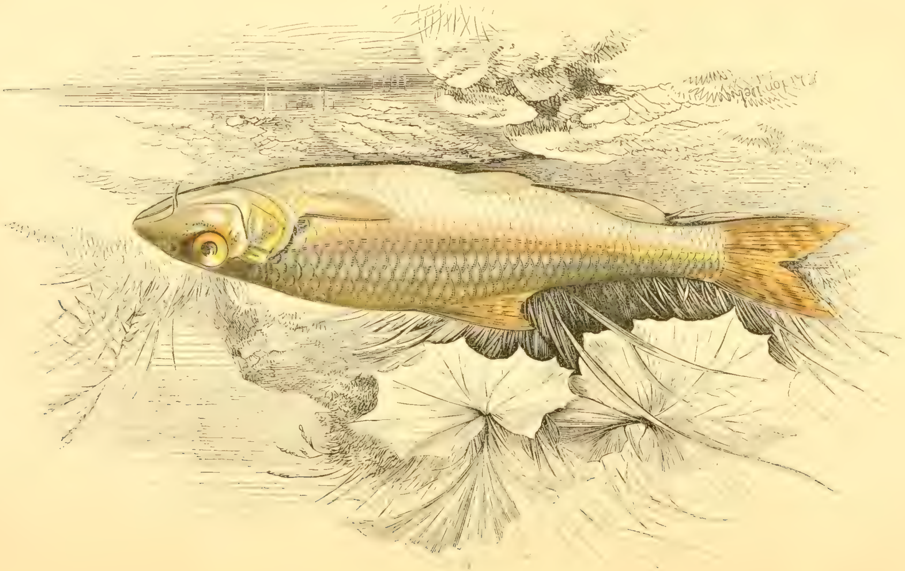
GOBIO.

This genus resembles *Cyprinus* in possessing barbels at the mouth; but it differs in having the dorsal and anal fins short, and in not possessing those spines in front of these fins by which the last-named genus is distinguished. The body also is more lengthened.

GUDGEON.

Gobio fluviatilis,	Jonston; Table 26, f. 16 and 17.
“ “	Willoughby; Pl. 28, f. 4, p. 264.
Cyprinus Gobio,	Linnæus. Bloch; Pl. 8, f. 2.
“ “	Donovan; Pl. 71. Jenyns; Manual, p. 405.
Gobio fluviatilis,	Fleming; Br. Animals, p. 186.
“ “	Yarrell; Br. Fishes, vol. i, p. 371.

Gudgeons delight in such of our rivers as flow with moderate velocity over a bottom of gravel, with deeper pits at convenient distances; in the latter of which they obtain shelter in the colder seasons of the year, but as warm weather advances they pass into the more rapid districts of the stream, and there display considerable activity, but more by night than by day; and especially in the search after food, in hunting for which their open nostrils afford them quick perception; and when an angler produces his baits they flock together in troops with proverbial eagerness to be caught. Their small size is indeed an hindrance to their being regarded as a valuable capture, although they are esteemed as a delicacy for the table, and their readiness to take the hook is an objection with those whose pleasure is to meet with fishes which task their skill in the art of angling. But to the less ambitious fishing for Gudgeons produces a good degree of excitement; and when the fish have ceased to bite freely, from perhaps the success that has lessened



their numbers, raking the gravelly bottom of the stream, or throwing into the water some enticing matters that shall flow on with the current will attract a larger assembly which shall renew the sport. Their food is worms, molluscous animals, and vegetables, which they seek near the bottom in winter; but they will not rise to a fly. It is even said that they will feed on the carcase of a dead animal, which may have fallen into the river.

The Gudgeon possesses the internal structure of hearing and perception which belong to others of this family; and its nostrils are especially open to the mingled impressions of smell and taste; but its more slender form and the love of the more rapid stream preserve it from the sluggishness which forms a large portion of the character of the Carp and Tench.

This fish is common in many of the rivers of Ireland, but it is not mentioned as occurring in Scotland, and it is known only of late in Cornwall or the west portion of Devonshire; but they thrive in some ponds at Penzance, into which they have been lately introduced. They are well known on the continent of Europe, but appear to be less common in Italy, although referred to in the south of France by Ausonius. It is also rare in Sweden, and occurs only in a few streams in the south of that country; up which they proceed in summer, from the neighbouring ponds and lakes, and to which they again retreat in the winter.

The Gudgeon grows to the length of about six inches, the body moderately lengthened, rounded, but a little compressed at the sides, and covered with scales; lateral line below the exact middle of the depth, straight; upper jaw slightly the longest, without teeth; but low in the gullet there are teeth as in others of the family. At the corners of the mouth a barb. Nostrils large, and a depression across the front before them. Eye moderate. Dorsal fin a little before the middle of the length, as long as broad, above the ventrals; anal fin shorter than the dorsal, behind the line of that fin; tail forked. Colour on the back brownish, or tending to bluish green; yellowish on the side, white below; the back, dorsal and caudal fins usually spotted, but the fins sometimes with stripes; anal, pectoral, and ventral fins plain.. Fin rays—the dorsal ten, anal nine, pectoral sixteen, ventral eight, caudal nineteen.

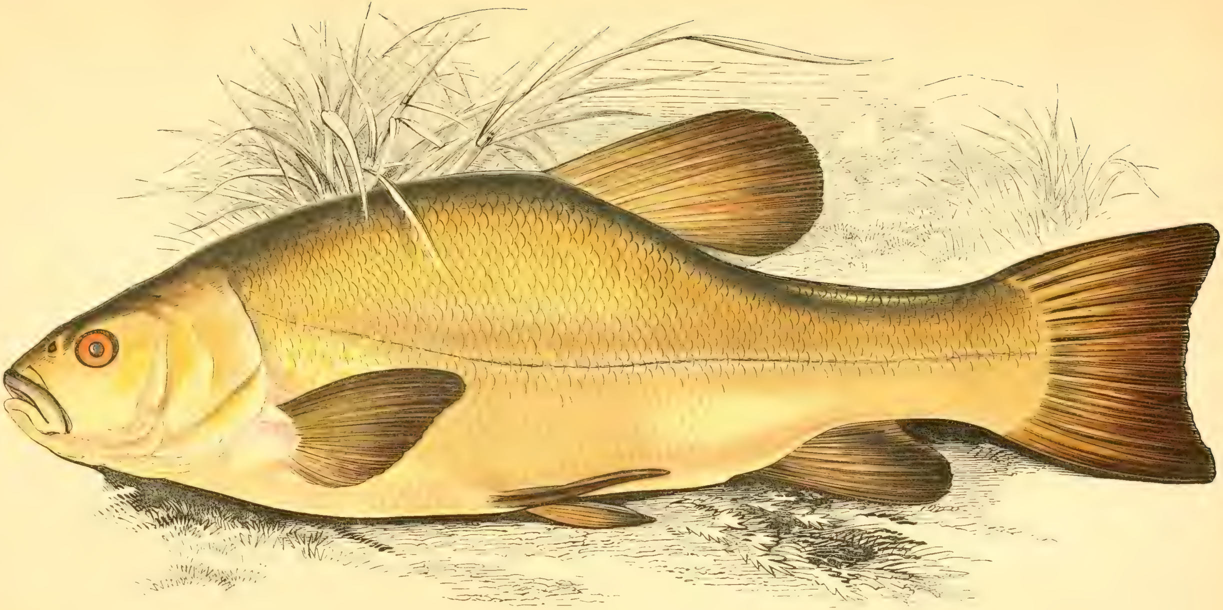
TINCA.

Cuvier forms a separate genus for the Tench, the character of which is, that in addition to other particulars of the genus *Cyprinus* the dorsal and anal fins are short, without firm spines to the fins; a single pair of small barbs at the angle of the mouth; scales on the body very small.

TENCH.

Tinca,	Jonston; pl. 29, fig. 7.
"	Willoughby; p. 251, Table Q. 5.
Cyprinus Tinca,	Linnæus. Bloch; pl. 14. Donovan; pl. 113.
" "	Jenyns; Manual, p. 405.
Tinca vulgaris,	Fleming; Br. Animals, p. 186.
" "	Yarrell; Br. Fishes, vol. i, p. 375.

There can be little doubt that the Tench was known to the ancients, since Willoughby informs us that it is occasionally found in the Tiber; and that it bore the name of Tinca, which is the origin of the English designation, appears from Ausonius, who is the only writer of his country that is known to mention it, at least with any particular reference to its nature or habits. And the reason of this omission appears to be that it was not in esteem with them for the table; which was the principal criterion by which the people of that day were accustomed to measure the value of any object that could be eaten. But we are referred to the writings of Cicero, from which we learn that in consequence of some appearance or property in this fish he chose to apply its name to an orator who was known for some amusing peculiarity that could find some analogy in the Tinca or Tench. In addition to this it may also be suspected that the species termed the Black Cyprinus by Ælian, an inhabitant of the Danube, and which has been referred to when we spake of the Carp, may rather be the Tench, as



TENCH

[illegible]

the descriptive epithet may more fitly apply to the latter than to the former.

There is reason to believe that the Tench has always been an inhabitant of our lakes and slowly-moving rivers, in the deeper portions of which, where weeds and mud abound, it finds congenial haunts; and where its food of vegetables, worms, and small fishes is easily and abundantly obtained. A slimy bottom is especially selected, and from this circumstance, as also from the slimy covering of its body, in which last particular it exceeds most fishes which possess scales, in some countries it has received its name. It has been observed that these fishes, which are fond of associating together, are much in the custom of licking from each other this mucous secretion, as they also are of nibbling any soft and fat substance, even of a wound which may have been received in assaults from one another. This nibbling of the raw surface has been interpreted into an intended healing process, and the Tench has accordingly been termed the Physician of fishes.

Holinshed believes that he is giving a proof that this fish is the Leach of fishes by saying—"for when the fishmonger has opened his (the Pike's) side, and laied out his rivet unto the buier for the better utterance of his ware, and cannot make him away at that present, he laieth the same againe into the proper place, and sowing up the wound, he restoreth him to the pond where Tenches are, who never cease to sucke and licke his greeved place, till they have restored him in health and made him readie to come againe to the stall when his turne shall come about." This idea of the healing virtue of the Tench's mouth, and not of the slimy exudation of its sides as a modern poet has surmised, has almost amounted to a superstition, and is referred to even in the Book of St. Albans; but it appears to have no other foundation than the love of this fish for the substance exuding from the wound, and the impunity with which the nibbling may be accomplished, with some benefit, although not an intended one, to the process of healing; but that it is less liable than other fishes to be devoured by the Pike may be a truth, although the cause of this exemption seems not easily explained. The Pilotfish swims near the Shark in safety, while other fishes cannot venture to do the same.

The Tench has much of the shrewdness ascribed to the Carp, as well as a large portion of the animal senses possessed by that fish. It is also sensible to the impressions of cold, and we are informed that in the colder months it will work a hole in the mud to shelter itself, and there lie concealed, perhaps for a longer time than is pleasing to itself, although from the power it possesses of extracting the minutest portions of air from almost exhausted water, it continues to live while other fishes must have perished. We are informed in a quotation from Johnson's "Sportsman's Cyclopædia," that at Thornville Royal, in Yorkshire, there was a pond that was to have been filled up, for which purpose wood and rubbish had been thrown into it for several years, so that it was almost choked up with mud and weeds. But in November, 1801, measures were taken to clear it out, in doing which, as very little water remained, no one expected to see any fish, except perhaps a few eels. Yet, to their surprise there were found nearly two hundred brace of Tenches, of all sizes, and as many Perch. And after the pond was supposed to be quite free, under some roots there seemed to be an animal which was conjectured to be an Otter. The place was then surrounded, when on opening an entrance among the roots a Tench was found, of a most singular form, having literally assumed the shape of the hole in which he had for many years been confined. Its length from fork to eye was two feet nine inches; its circumference, almost to the tail, two feet three inches; the weight eleven pounds nine ounces and a quarter; the colour also was singular, the belly being that of a Char, or vermilion. This fish was examined by many gentlemen, and then carefully placed in the pond; but either from confinement, age, or bulk, it at first merely floated, and at last with difficulty swam gently away.

This fish is not a native of the western counties of England, nor probably of Ireland or Scotland; but as, like the Carp, it is so retentive of life as to be conveyed easily to distant places, it is found at present in all these districts where situations can be found to suit its habits; and it breeds readily where the soil and water are congenial to it, but indeed there only. It is of use to know that for the fertility of a pond the number of males ought to be double that of females, and it so happens that the sexes of this fish are readily to be distinguished by the comparative size of their ventral fins; which in the male are far the largest, with a stout, thick, crooked, and transversely striated first ray. The bones also to which these fins are attached are large, thick, and extended even to the gill openings.

Willoughby remarks, from Schenckfield, that the Tench spawns at the time when wheat is in blossom. The spawn is shed at no great depth in the water, and the development of the grains is rapid, as they were traced by M. Rusconi in Muller's "Archives," for 1836; who observes that soon after the application of the milt the ovum loses its spherical form, and swells out into the form of a pear, and at the point where the swelling begins it is surrounded with a cluster of microscopic globules, which before were spread all over its surface. In half an hour the pear-shaped excrescence is divided into four globules, which in another quarter of an hour are subdivided into eight, and after a similar period into thirty-two, which still remain clustered together on the top of the egg. In another half hour more globules appear, which become less in size as they increase in numbers, and at length from their minuteness that part of the egg to which they are attached becomes almost as smooth as before they made their appearance. The embryo fish is now seen in the form of a whitish transparent speck, which is the rudiment of the backbone. The organization of the skin then proceeds, and the embryo as it is coiled round the yolk increases in length until the head becomes perceptible. In forty hours from the first this embryo Tench gives signs of motion, and in further twelve hours it has freed itself from the skin of the egg; at which time the fish is two lines in length, and the blood is of its natural colour. For some hours after leaving the egg the young appear inert; lying on their sides and unable to swim; but when the swimming bladder becomes developed they assume their proper position and activity. The intestines are not fully developed until seven days from leaving the egg; and then they begin to feed voraciously, but only on animal substances.

The narrative here given may be considered as generally applicable to fishes of this family, and in its outline to fishes in general; since the variation is rather connected with the quickness of the development than the mere order of the proceeding; and in regard to quickness it is much influenced by the temperature of the water, which in the case here described was above seventy degrees. The growth of the Tench afterwards is speedy, so that in twelve months it may weigh from half a pound to a pound; and an instance is known where a Tench placed in a pond in six years and a half attained to the weight of four pounds and a half—which is what it most frequently reaches in England.

We have not thought it necessary for the most part to describe the methods used in Britain in fishing for those species which inhabit our fresh waters, since there are numerous volumes which treat on this subject at greater length than our space will allow; but we copy the following from the Reverend Richard Lubbock's "Fauna of Norfolk," because it includes a lively picture of some particulars of the nature of this fish:—

"In Norfolk there are fishermen who for catching Tench in shallow water prefer their own hands, with a landing-net to be used occasionally, to any other engines. The day for this operation cannot be too calm or too hot. During the heats of summer, but especially at the time of spawning, Tench delight in lying near the surface of the water amongst beds of reeds; in such situations they are found in parties, varying from four or five to thirty in number. On the very near approach of a boat they strike away, dispersing in different directions, and then the sport of the Tench-catcher begins. He perceives where some particular fish has stopped in its flight, which is seldom more than a few yards; his guide in this is the bubble which rises generally where the fish stops. Approaching the place as gently as possible in his boat, which must be small, light, and steady in her bearings, he keeps her steady with his pole, and lying down with his head over the gunwale, and his right arm bared to the shoulder, taking advantage in his search, of light and shade, he gently with his fingers displaces the weeds, and endeavours to descry the Tench in his retreat. If the fisherman can see part of the fish, so as to determine which way the head lies, the certainty of capture is much increased; but if he cannot, immersing his arm, he feels slowly and cautiously about until he touches it; which, if done gently on head or body, is generally disregarded by this sluggish and stupid fish; but if the tail is the part molested, a dash away again is the usual consequence. Should the fisherman succeed in ascertaining the position of the fish, he insinuates one hand, which alone is used, under it just behind the gills, and raises it gently, but yet rapidly, towards the surface of the water. In lifting it over the side of the boat, which should be low, he takes care not to touch the gunwale with his knuckles, as the slightest jar makes the captive flounce and struggle. On being laid down the Tench often remains motionless for full a minute, and then begins apparently to perceive the fraud practised upon it. The fisherman then, if he marked more than one Tench when the shoal dispersed, proceeds to search for it. If not he endeavours to start another by striking his pole against the side or bottom of the boat. The concussion moves other fish, when the same manœuvres are repeated. In the course of a favourable day one fisherman will easily secure five or six dozen. The *run*, as it is termed, of a Tench is different from that of a Bream or Rud. It is not straight or extended, but short, varying, and devious. Very often the fish halts within five or six yards of the place it started from; and a good-sized fish is more easily taken than a small one."

The shape of the Tench is generally thick and solid, but compressed at the sides; its breadth (or depth) being conveyed almost to the tail, and if our figure is less so, it is because of the form of the individual example. In England it does not often exceed four or five pounds in weight, but old fishes grow to a more considerable size, especially on the continent. The gape is moderate, jaws nearly equal, lips fleshy, without teeth; a slight barb at the corner; the palate is fleshy only on its posterior half. The back rises from the snout to the dorsal fin. Eye small; body clothed with small fine scales; the lateral line drops at first, and then passes straight to the tail. Dorsal fin, a little behind the middle of the body; as wide as long; anal behind the termination of the dorsal; pectoral fin broad, and the ventrals rather so. Tail straight or a little rounded. Colour of the back and fins rich dark brown; sides fulvous brown or yellow, lighter below. Eye red. The dorsal fin has nine rays, the first short, and the anal has the same; pectoral fourteen, ventral nine, caudal seventeen.

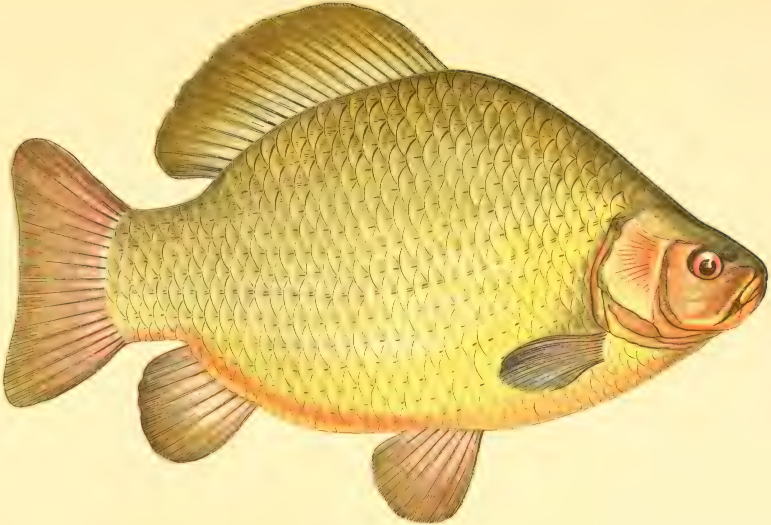
CARASSIUS.

We arrange as in a separate genus those species which have the general characters of *Cyprinus*, as defined by Cuvier, with an extended dorsal fin and short anal; but the mouth without barbs, and not having a firm denticulated ray to the dorsal and anal fins. Some appearance of such a toothed ray may be perceived in one or two of these species, but so obscurely as to be scarcely discernible.

CRUCIAN.

Carassius,	Willoughby; p. 269, pl. Q. 6; but he does not distinguish it from some other species, as *Alburnus* and *Ballerus*.
Cyprinus carassius,	Linnæus. Cuvier. Bloch; pl. 11.
" "	Jenyns; Manual, p. 403.
" "	Yarrell; British Fishes, vol. i, p. 355.

So little was formerly known of this fish that Gesner says he could not find it had been mentioned by any writer before Dubravius, and much uncertainty still rests upon it when considered as a British fish; for although Pennant mentions a fish of this name as known to himself, it is supposed to have been by mistake for the Prussian Carp; and Mr. Yarrell had obtained it in a few instances from the Thames; yet this is consistent with the belief that the species was at first introduced among us, and that even at a recent date. This indeed is asserted or implied in the experiments of which it was the subject; and of which an account is given in our history of the Carp. In what is there referred to the examples had been procured from Hamburg, where the fish appears to have been well known; for Linnæus refers to the Acts or Transactions of the University of Upsal, where it is called by the elder Gronovius *Cyprinus Hamburger*, as characteristic of the place where chiefly it was found.



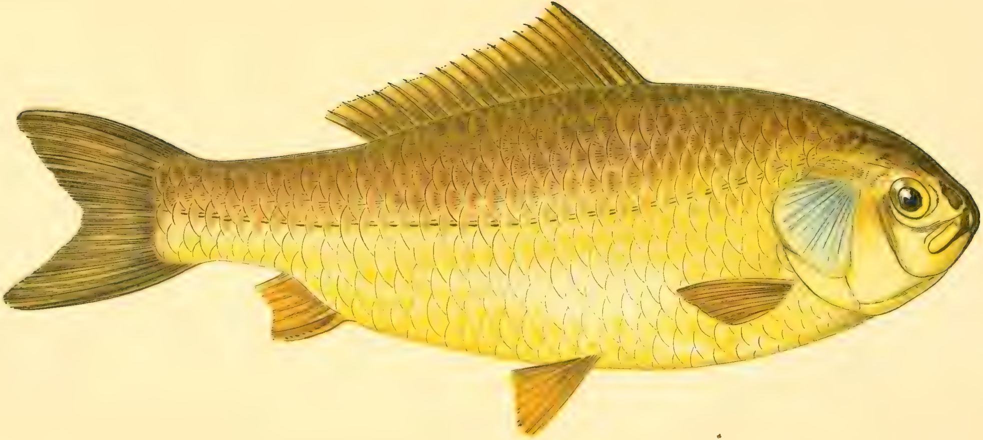
CRUCIAN.

It is easy to suppose that some of these fishes which had been obtained from the continent of Europe, where they are not rare, may have been set free in the Thames without having been operated on in the manner described, and there they may have continued the race; but that the operation from which we have an account of their introduction into England was not such a novelty as was supposed, is rendered probable from the lines of Sir Philip Sidney, although the operation was performed upon another species:—

> We have a fish by strangers much admired,
> Which caught to cruel search yields his chief part;
> (With gall cut out) closed up again by art,
> Yet lives until his life be new required.
> SEVEN WONDERS OF ENGLAND.

The Crucian, like most of the species of this family is highly retentive of life, and in consequence may be conveyed to considerable distances for the purpose of being propagated in ponds or slowly-flowing rivers; but it will scarcely repay the expense or effort, as it is not highly esteemed for the table, and it never becomes equal to the Carp in size. It is said to be of slow growth. We copy the figure of this fish given by Fries and Ekstrom, with a large portion of their description.

In its early growth it bears some resemblance to the Carp, but its shape is much deeper; in which particular it exceeds the whole of this family; for its greatest depth is equal to one half of its length. It may be further distinguished from the Carp by the absence of barbs at the mouth. The jaws are equal and without teeth, gape small; body thick and solid, but compressed; the outline ascends from the snout, and more especially from the head, to the origin of the dorsal fin; from which again it descends in an oval to the origin of the tail. Scales large, thirty-two on the course of the lateral line; this line descends at first, and then straight. Eye rather small; hindmost gill-cover divergently striped. Pectoral fin round, with fifteen rays; ventrals also round, with nine rays; dorsal fin long, beginning over the ventrals, wide, with a rounded outline, and twenty rays; anal fin wide, rather short, with ten rays; the third rays of the dorsal and anal fins, which are longer than the preceding, thick and very finely notched; tail short, wide, nearly straight, with eighteen rays. The colour is subject to variety; top of the head and back brown, or with a tint of green, yellow on the sides, white or orange colour on the belly; the fins generally dark with a tint of red. It rarely exceeds two pounds in weight, and most frequently is less; but Mr. Yarrell obtained an example from the Thames that weighed two pounds and eleven ounces.

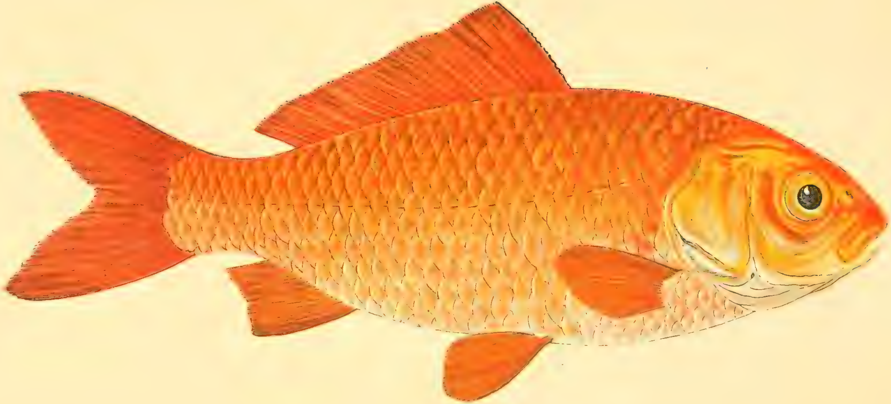


PRUSSIAN CARP.

Cyprinus Gibelio,	Bloch; pl. 12. Jenyns; Manual, p. 402.
" "	Yarrell; Br. Fishes, vol. i, p. 358.
Carassius Gibelio,	Nobis.

The Prussian Carp appears to be one of two or three species which have been confounded together under the name of Crucian, Carassius, or Charax; but this last name must be kept separate, as when found in the work of Oppian it is applied to a fish of the sea, and the word in its origin is believed to refer to the sharp or prickly arming of the back. Whether originally a native of England appears uncertain, but there is no notice of its having been introduced into our ponds or deeper slowly-flowing rivers; in which it is sometimes found in considerable numbers. We have obtained it from the Thames, where it abounds more than does the Crucian; but its particular habits have not been attended to, except that it is known to be highly retentive of life when uninjured out of the water.

This fish is said to have reached the weight of two pounds, but the example described was much less; the length to the fork of the tail seven inches, depth in front of the dorsal fin one inch and seven eighths; the proportions stout and thick, blunt over the front; wide between the eyes, mouth small, jaws nearly equal, without teeth. Eyes moderate; body rising from the mouth to the dorsal fin; back round. Scales on the body large; lateral line at first high, but after sinking a little proceeding straight; with thirty-five perforated scales. Posterior plate of the gill-covers finely striated. The dorsal fin begins a little anterior to the line of the ventrals and ends above the vent; its first ray short, the second strong and serrated; anal small, its first ray serrated; tail bluntly forked. Colour yellowish brown on the back, and so the dorsal fin and tail, yellow on the sides, brighter below; pectoral, ventral, and anal reddish or orange; posterior plate of the gill-cover with a tint of blue. The dorsal fin has eighteen rays, ventral eight, anal nine. Its distinction from the Crucian is seen in the less depth of the body, blunter head, less elevation of the dorsal fin, sharper pectoral, smaller anal; and in the fork of the tail.



GOLDFISH.

CLXXXVI

GOLDFISH.

Cyprinus auratus,	Linnæus. Cuvier. Bloch; pl. 15.
" "	Jenyns; Manual, p. 403.
" "	Yarrell; Br. Fishes, vol. i, p. 361.

This fish is a native of China, where for ages it has contributed to the amusement of the higher classes by its lively actions in luxurious captivity, as also to the occupation and profit of the more industrious classes by the employment it affords them in procuring and propagating the numerous varieties of its race; for as there is no other fish which has been so long in such a condition of training, so there is none that has so decidedly shewn such a tendency to be influenced by it in shape and colour. We are informed that in that country it is a special business to collect the spawn as it floats in the great rivers, and to sell it to merchants who send it to different districts of the country, to be propagated in small ponds, in which also the fish are preserved; but for amusement also they are kept in porcelain vessels in the houses of rich people. In captivity they are not prolific except in ponds suited to their nature, of which warmth is an important particular; so that they live and thrive in that which to our imagination seems beyond the power of any living creature to sustain. As an instance it is known that in manufacturing districts, where there is a short supply of cold water for condensing the steam employed in the engines, recourse is had to what are called engine dams or ponds, into which the water from the steam-engine is thrown for the purpose of being cooled; and in these dams, the average temperature of which is about eighty degrees, it is common to keep Goldfishes. It is a known fact that in these situations they multiply much more rapidly than in ponds of lower temperature that are exposed to variations of the climate. Three pairs of these fishes were put into one of these dams, where they increased so rapidly that at the end of three years, when their progeny was accidentally poisoned by verdigris mixed with the refuse tallow from the engine, wheelbarrows full of them were taken out. In those dams Goldfish are by no means useless inhabitants, since they consume the refuse grease which would otherwise impede the cooling of the water by accumulating on the surface. Another important particular to their well-being in a small pond is, that there should be in some part of it a good depth of water and shelter, both for hiding and as a retreat on the change of seasons; a change of which all fishes are highly sensible, and none more than those of the family of Carps.

These beautiful fishes, which bear well even close confinement in a glass globe, although they do not reach their full size in it, are easily conveyed from place to place; and accordingly we learn that some examples of them were brought from China into England in the year 1691. But they did not become generally known until a considerable number were also brought in the year 1728, and presented to Sir Matthew Dekker, Lord Mayor of London, who made presents of them to several friends, by which means they became distributed through the country. They are now well known throughout the civilized world, although rather as the petted favourites of the house than as naturalized inhabitants of our waters. A large portion of those we have in England have been brought from Lisbon, where they are bred for sale.

In form this fish much resembles the Carp; the body deep, moderately compressed; jaws equal, the outline rising to the beginning of the dorsal fin; eyes prominent; body covered with large scales; lateral line a little depressed at its origin, afterwards straight. The dorsal fin begins opposite the middle of the pectoral, and ends opposite the middle of the anal; the latter short; the first ray of the former usually toothed, as is the hindmost border of the first ray of the latter; pectorals round, ventrals large; tail incurved. The colour from deep orange to golden, a little lighter on the belly, but subject to variety; the young being very dark, and when older of a bright silver, on which account they are called silver fish; and some are strongly tinged with pink. There is also remarkable variety in the fins as they are found in captivity; some being without the dorsal fin, some having it short, with three lobes on the caudal fin, and sometimes the lower lobe of this fin is separated into two, which are spread abroad horizontally. Linnæus has, in mistake, made this last particular a portion of the character of the genus, and Gronovius supposed it to be the mark of a separate species.

ABRAMIS.

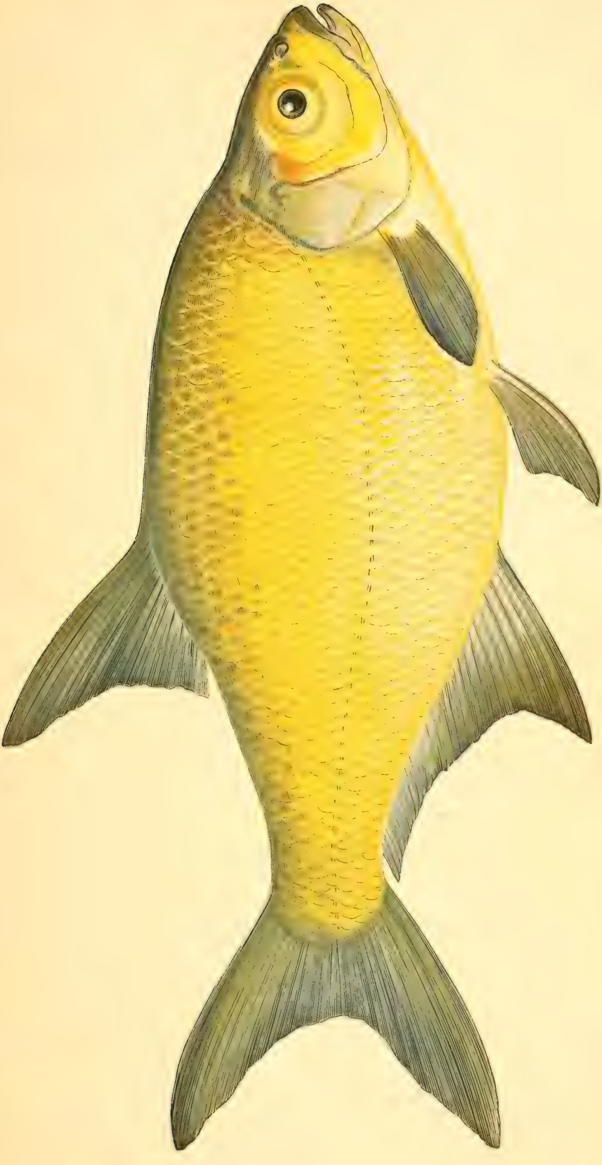
The character is, that the body is deep, belly not armed with rough points, dorsal fin short and placed behind the ventrals, anal fin long, and both without a spinous ray; no barbs at the mouth.

LAKE BREAM.

CARP BREAM. YELLOW BREAM. COMMON BREAM.

Cyprinus Latus,	Jonston; Table 29, f. 5.
“ “	Willoughby; p. 248, plate Q 10.
“ *Brama,*	Linnæus.
“ “	Bloch; pl. 13. Donovan; pl. 93.
“ “	Jenyns; Manual, p. 406.
Abramis vulgaris,	Cuvier.
“ *Brama,*	Fleming; Br. Animals, p. 187.
“ “	Yarrell; Br. Fishes, vol. i, p. 382.

There are only some particular situations where the Lake or Carp Bream is found, but where it meets with a congenial soil and water, its numbers increase in a remarkable degree. And although sensitive to the variation of seasons, there is nothing in the climate of the United Kingdom that is hurtful to it; for as regards cold they abound even at the most northern parts of Norway, while with ourselves they associate in companies, and are lively in the warmest summers. But neither a swiftly-flowing stream nor pebbly bottom are suitable, and they chiefly rejoice in still water with a bottom of soft soil, whether in lakes and ponds or rivers. Nilsson remarks that they in Sweden are sure to be found where the pond-weed *Isoetes lacustris* grows; but slimy food, with other digestible vegetables, serves them for nourishment, and they devour with eagerness the paste prepared for them by anglers, by which they are attracted



to a spot where they are to be fished for, and where they seize the worms with which the hooks are baited. Izaak Walton gives directions for the successful practice of fishing for these Bream, for information concerning which we refer to the well-known and amusing volume of this patriarch of fishermen. They are not found in Cornwall or Devonshire. Fleming mentions it indefinitely, as being found in Scotland; and he quotes Pennant as authority for its inhabiting Loch Maben; but it seems not to be an inhabitant of the far north of that kingdom.

Leland also says in his own quaint language that in Wales, not far from Breckenok, in Llin Senatham; which is in bredth a mile, and a two miles of length, and wher as it is depest a thirteen fadom, it berith as the principale fisch a great numbre of Bremes, and they appere in May in mighti sculles. So that sumtime they breke large nettes; and ons frayed appereth not in the bryme of the water that yere againe.

By favour of the Earl of Enniskillen I learn that large numbers inhabit the lakes of the north of Ireland; and especially they abound in Lough Erne, Lough Mackean, and others in Fermanagh, Cavan, and other counties; and I have been indebted to that Noble Lord for several examples from these districts, from which we have derived our figure and description. A net is the instrument chiefly had recourse to in that part of the country; and as these fish are not generally in high esteem, (and, in fact, from their numbers, when the hope is to take other fishes, they are usually considered an annoyance,) they for the most part fall to the lot of the poorer people, who preserve them for use in winter.

Yet although this is the character which the Bream now generally bears it was not always so. Chaucer speaks favourably of it, and the value set on this fish about the year 1419 may be learned from Sir William Dugdale, who informs us that at that date a single fish was valued at twenty pence, when the day's labour of a mason or master carpenter was less than sixpence; from which was withdrawn three halfpence if his food was supplied to him. We are told also that a pie containing four Bream was sent from Warwickshire to a distant part of Yorkshire at the cost of sixteen shillings; which amount included the wages of two men for three days in catching the fish, together with the flour and spices for making the pie and the charge of conveying it to its destination.—(Pictorial History of England, vol. ii.) The Book of St. Albans is a further witness, that "the Breeme" was accounted "a noble fysshe and a deyntous," for the taking of which particular directions were given.

This Bream is considered a very shy fish, and as their ordinary habit is to swim in shoals, Nilsson informs us that in the season when the fishery is carried on in Sweden, in some of the parishes near the lake where these fish abound, it is forbidden to ring the church bells; that the noise may not drive the fish away. Sometimes the success of this fishery is such that from ten to forty thousand pounds of Bream have been taken at a single haul of the net.

A reason why this fish is not regarded at genteel tables with us is said to be, that they are furnished with such a large abundance of small bones, which is in fact a double row of ribs corresponding to those of the herring, shad, and pilchard; and it is on this account that the middle portion of the body is preferred to the rest; but in autumn, Walton says, they become "as fat as a hog," and then they afford a not unpleasant dish.

The time of spawning is about the month of May, at which time the male is marked with rough white spots about the head. In the "Fauna of Norfolk" it is remarked that when preparing to spawn they roll about like miniature porpoises; the water is discoloured by their working; here a nose appears and there a back fin, whilst at intervals a plunge of affright amongst the multitude shews that large pike are busy. They are a positive nuisance from their numbers in many places. If a bow-net is set for Tench, Bream crowd in ere they arrive and exclude them. At first the growth of the young is slow, and they are not readily distinguished from the next species, *A. Blicca;* but in the course of time they reach to a large size, and, while a Bream of the weight of fourteen pounds is considered of large size, Rondeletius professess to have seen an example that measured two cubits in length, with a foot at the greatest depth.

That this fish is retentive of life, and especially possesses great power in resisting extreme cold, appears from an instance mentioned by Gesner, and often since referred to.—It happened that in Poland a large number were contained in a tank, the water of which became frozen so entirely that not one of the fish could be seen; but when the frost disappeared the Bream again appeared without having suffered harm.

Length of the example from the snout to the fork of the tail sixteen inches; greatest depth, which is about the beginning of the dorsal fin, seven inches and a fourth. Head small; the outline rising rapidly from the nape, and beginning to slope downward from the dorsal fin towards the tail; the body, exclusive of the tail, approaching to an oval. Snout round, under jaw slightly the shortest; no teeth, lips fleshy, slightly bent up at the middle. Eyes lateral, large; nostrils open, in a depression, high on the front, with a band or depression above the lips from one nostril to the other. Body much compressed, scales rather large; lateral line falling below the level of the body. Dorsal fin elevated, behind the middle of the body, ending nearly opposite the vent; anal fin from the vent near to the tail, hook-shaped at the beginning. Pectoral fin rounded, ventrals before the origin of the dorsal, and reaching to the vent; tail forked. Colour bright yellow, darker on the back, pale below.

Fin rays—in the dorsal eleven, caudal seventeen, anal twenty-nine, pectoral sixteen, ventral nine.

WHITE BREAM.

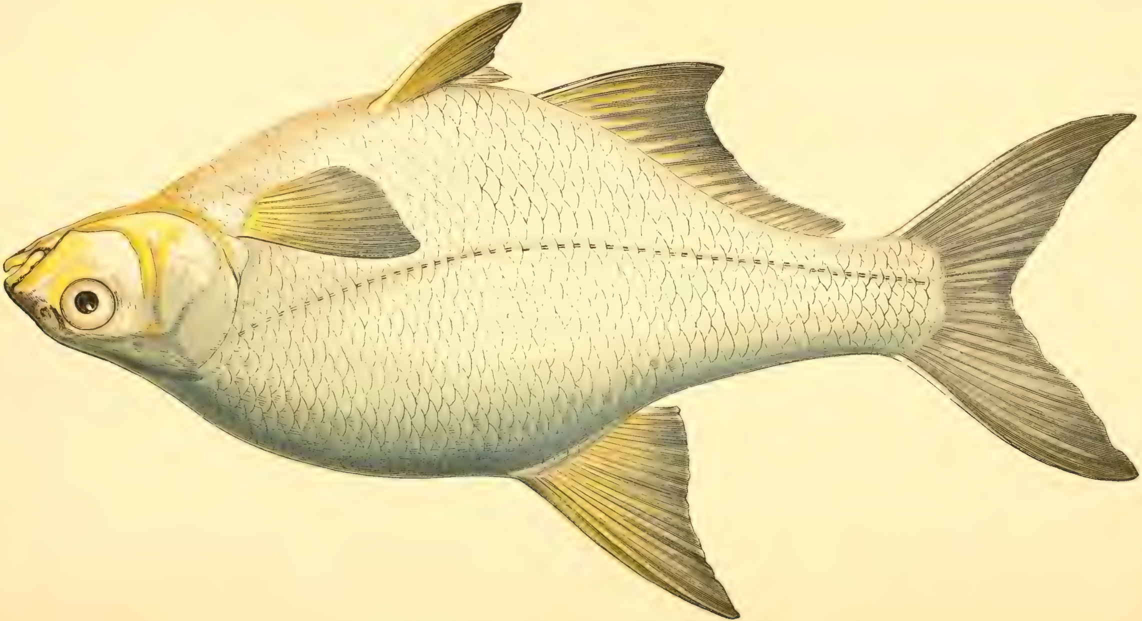
BREAMFLAT.

Cyprinus Latus,	TURTON'S Linnæus.
“ *Blicca,*	BLOCH; pl. 10.
Abramis Blicca,	CUVIER.
Cyprinus Blicca,	JENYNS; Manual, p. 407.
“ “	YARRELL; Br. Fishes, vol. i, p. 387.

IT was long doubted whether what was supposed to be a second species of Bream in our lakes was truly distinct; and after a close examination of what was alleged to be such on the continent of Europe, it remained the opinion of the learned naturalist Gesner, that only one species could be recognised. And the opinion thus expressed was not without some plausible grounds, so far as regarded the fishes we have called the Lake and White Breams; since whatever may be the assigned marks and distinction at the fullest stage of growth, when the Lake Bream is of a bright yellow colour, and it is of much larger size than the White Bream is ever known to attain; yet at an earlier stage, when the Lake Bream is only half grown, the colour of both these fishes is so much alike, and the other differences between them require such close examination that we need not feel surprised if the real points of distinction are not always detected. Yet that they were believed to be distinct fishes in very early times appears from the Book of St. Albans, where Bremettis are mentioned separately, as to be fished for with some difference of baits; and that they are distinct fishes is now generally admitted; but although whatever difference may exist in their habits is not well known, in this respect also some distinction must exist since there are places where the White Bream is common, and the Lake Bream is not met with. Mr. Jenyns points to some districts of the River Cam

[illegible]

[illegible]



as an instance of this, and it appears not unlikely that the reverse of this is the case in some parts of Ireland.

It might have been preferable to have limited to the species now under consideration the name of Shude, which is used in the north of Ireland for the early stage of both these fishes, and for the latter during the whole of its existence; but we have decided otherwise in order to avoid confusion. At the same time it should be borne in mind that the Lake Bream is equally white until of nearly full growth, and also that in Ekstrom's "History of Scandinavian Fishes," the figure of *Abramis Blicca* is decidedly yellow.

Instead of giving an extended description of the White Bream, we will simply point out those characters by which it may be distinguished from the Lake Bream, with which alone it is likely to be confounded; and in doing this we prefer to select these points to which attention has been particularly directed by writers whose opportunities of comparison have been the greatest; as by this means we avoid those mistakes which might be committed in confounding casual differences with such as impress a permanent character.

The White Bream rarely exceeds the length of a foot, and a usual weight is about a pound. Nilsson says that the outline of the body is more arched than in the Lake Bream; but the proportions of the younger fish are more lengthened than when it has become older, and in that early condition it more closely resembles the last-named fish. Both jaws are also more nearly equal; the head large; back much compressed; over the neck a depression, from which the arch rises to the dorsal fin, beyond which to the tail is straight, so that the space at the tail is wider (or deeper.) The lateral line is not so low on the body as in the Lake Bream; scales large and thin. Colour of the back bluish brown, sides white tinged with blue, white below; pectoral and ventral fins reddish, other fins brownish grey.

Fin rays—dorsal ten, pectoral eighteen, ventral nine, anal twenty-four or five, caudal nineteen. Both Nilsson and Mr. Yarrell assign to the pectoral fins three less, and to the anal five, than in the Lake Bream, but the last-named author gives twenty-two as the number of rays in the anal fin.

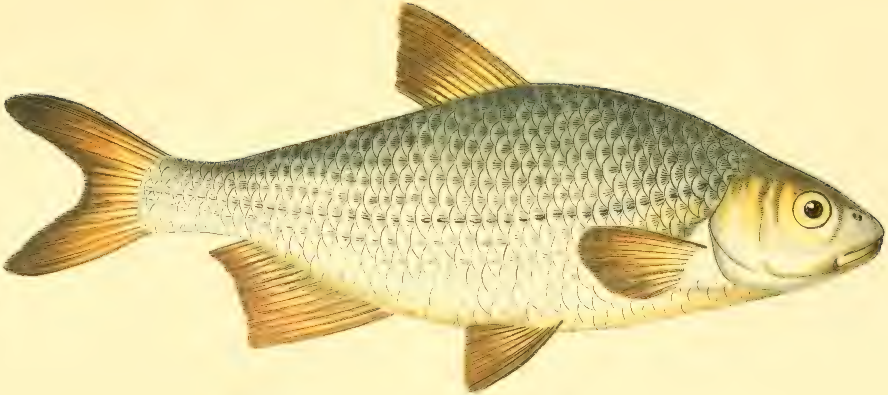
POMERANIAN BREAM.

Cyprinus Buggenhagii,	Bloch; Pl. 95.
Abramis Buggenhagii,	Cuvier. Thompson.
" "	Yarrell; Br. Fishes, vol. i, p. 391.

A third species of British Bream was first announced by Mr. William Thompson as obtained by him in Ireland, and we shall borrow his account of this fish, as it is contained in his Natural History of that portion of the United Kingdom; but it has also been found in England by Mr. Yarrell, to whom it was presented from the Dagenham Breach, and afterwards from another portion of the Thames; and it has likewise been obtained by Mr. Jenyns in Cambridgeshire. But previous to this it had been described by the Prussian naturalist Bloch, who obtained examples from Pomerania; from which country they had been sent to him by a gentleman whose name he affixed to the species, and who therefore must be pronounced its first discoverer.

It has not been recognised in any other country besides those we have here specified; and everywhere it appears to be a scarce species. We may suppose therefore that it is less prolific than the others of this genus, or that it is beset with much more formidable enemies.

Mr. Thompson's notice of it is, that it has been taken in the sluggish River Lagan, in which the (Lake) Bream is abundant. On inspecting the produce of a fishing-rod at the River Lagan, near Belfast, I detected a Bream differing from the common species. It agreed so fully with Bloch's description of the *Cyprinus Buggenhagii* as to satisfy me of its identity, the only difference consisting in the number of rays in the pectoral fin, twelve being enumerated by him, and eighteen appearing in the specimen; "several of them, however, being very short may have



POMERANIAN BREAM

CLXXXIX

escaped Bloch's notice. The description drawn from my specimen: —Length five inches and a half, depth an inch and a half; head one fourth of the entire length; diameter of the eye equal to one fourth of the length of the head; scales on the lateral line about forty-five. Colour of the sides silvery, tinged with blue towards the back; dorsal, pectoral, ventral, and anal fins nearly transparent, or slightly tinged with dusky; tail pale yellow."

An example obtained by Mr. Yarrell measured fifteen inches in length; and it has been noticed that while the depth of the body measures one third of the length, the thickness amounts to one half of the depth, being the thickest of all the Breams. The dorsal fin also is larger than in them, and the anal fin shorter, with three rays less in number.

LEUCISCUS.

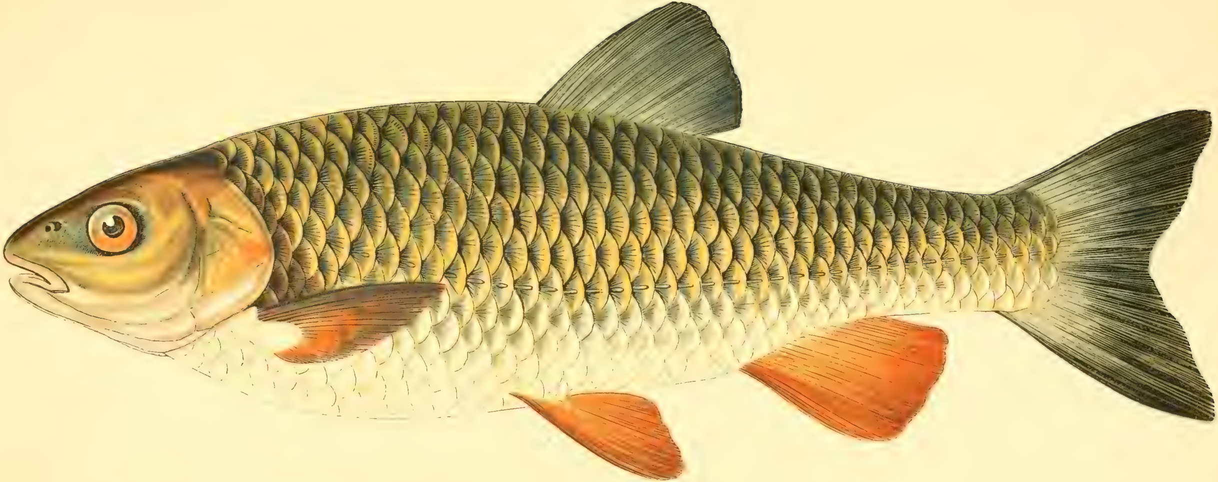
With the usual characters of the family of Carps, the dorsal and anal fins are short; and they have not any barbs, or spines to the fins.

CHUB.

CHEVIN.

Capito,	Jonston; Table 26, f. 7.
"	Willoughby; p. 255, plate Q. 10.
Cyprinus cephalus,	Linnæus.
" *Jeses,*	Bloch; pl. 6. Donovan; pl. 115.
Leuciscus cephalus,	Fleming; British Animals, p. 187.
Cyprinus cephalus,	Jenyns; Manual, p. 411.
" "	Yarrell; British Fishes, vol. i, p. 409.

In its habits the Chub so far agrees with several others of this family, that it is found only in rivers which possess a good depth and supply of water; and also that it manifests much sensibility to changes of temperature in the different seasons. But, on the other hand, it prefers those streams in which the water flows with some considerable rapidity along a clean bottom of sand or gravel; and so needful to its well-being is a supply of what is afforded by a current, that it is not easy to keep it alive in a tank, or within the narrow limits of a pond. It is necessary, however, that its native stream should possess some safe and shaded pits or deeper recesses, to which it may retreat from danger, of the slightest appearance of which it is timidly sensible; and also where it may hide when the sun shines hot, and during the colder season of the year. From some causes connected with this repugnancy to still or stagnant water, or to the want of congenial retreat, this fish does not exist in the rivers of the north of Scotland, or in



CHUB.

CXC

the west of England; and if any attempt has been made to introduce it into these districts—of which, however, we have not received any information—it has not been successful. Nor indeed, except for curiosity, is its conveyance likely to be attempted; for the Chub does not possess a reputation as food that is likely to induce any one to venture the task. The Roman poet Ausonius in a few verses bestows on it this character of being little worth, when he says:—

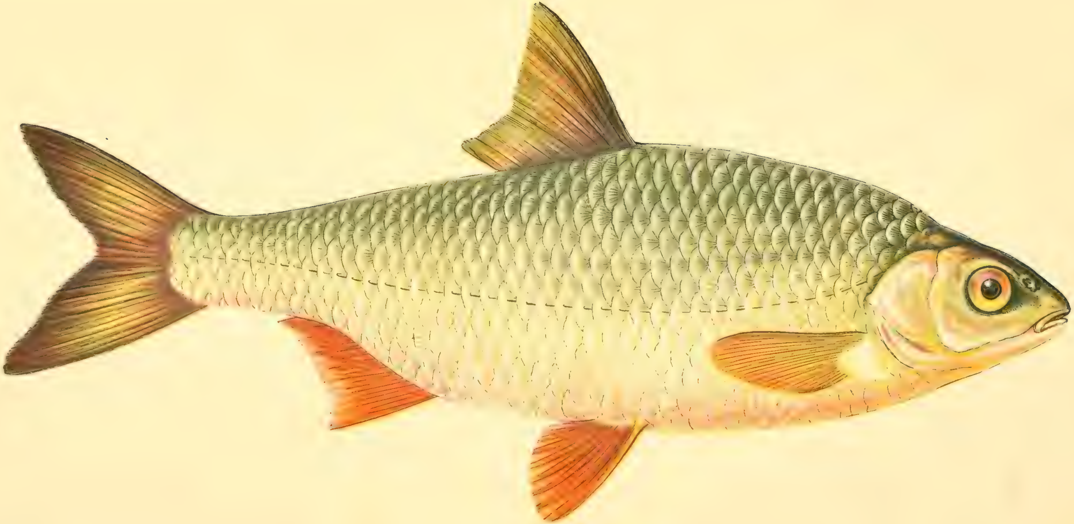
"In weedy sands the scale-clad Chub delights;
Its sides thick-studded with sharp reed-like bones,
Nor can we keep its flesh beyond six hours:"

in which last particular we must offer a correction to what by a slip of the pen was advanced when speaking of the Grey Mullet. It is the Chub and not the Mullet, that in the poetry of Ausonius bears the name of Capito. The most esteemed portion of this fish was supposed to be the head, the stoutness or thickness of the sides of which appear to have given occasion to the name, as well perhaps in the English as in the Latin language. This fish is met with in many portions of the continent of Europe, and so far north as Sweden and a portion of Finland; but it is not a native of Ireland.

The Chub, like the generality of the Carps, feeds much on vegetables; but it also eagerly devours insects, and readily takes the hook when baited with a worm or molluscous animal; but the method of angling for it, as well as of cooking it when caught, will be found at large in the work of Izaak Walton. This, however, to a small extent, we prefer to give as recorded in the less common Book of St. Albans:—"The Chevyn is a stately fysshe; and his heed is a deyty morsell. There is noo fysshe so strongly enarmyed wyth scalys on the body. And bicause he is a stronge byter he hath the more baytes, which ben thyse." We need not specify the whole of these, as they are varied through the year; but a sample of them may be seen in the "yonge frogshys the three fete kitte of by the body [a young frog having its three feet cut off close to the body,] and the fourth close to the knee."

The time of spawning is early in the summer.

The example described, which was obtained from Yorkshire, was in length fourteen inches, and in depth in a straight line three inches and almost a fourth; the form stout, compressed at the sides, wide and round over the head and back. Gape moderate, jaws nearly equal, upper lip broad, mouth and tongue fleshy, palate having a folded membrane; no teeth; nostrils close together, open, in a depression. Eye moderate. Scales on the body large and firm; lateral line descending, passing to the tail lower than the middle of the body. Dorsal fin single, elevated, behind the line of the ventrals, having nine rays; pectorals low, rounded, with fifteen rays; the anal begins midway between the root of the ventrals and of the caudal, with ten rays; tail a little concave, with nineteen rays. The ventrals have eleven rays; the first two firm and simple. Colour disposed to dark olive on the top of the head, on the body dark grey with a tinge of blue, browner above, whiter below; the scales dark at the angle. The tail dark, anal and ventrals orange, faint on the hindmost rays. Eyes orange, reddish above.



ROACH

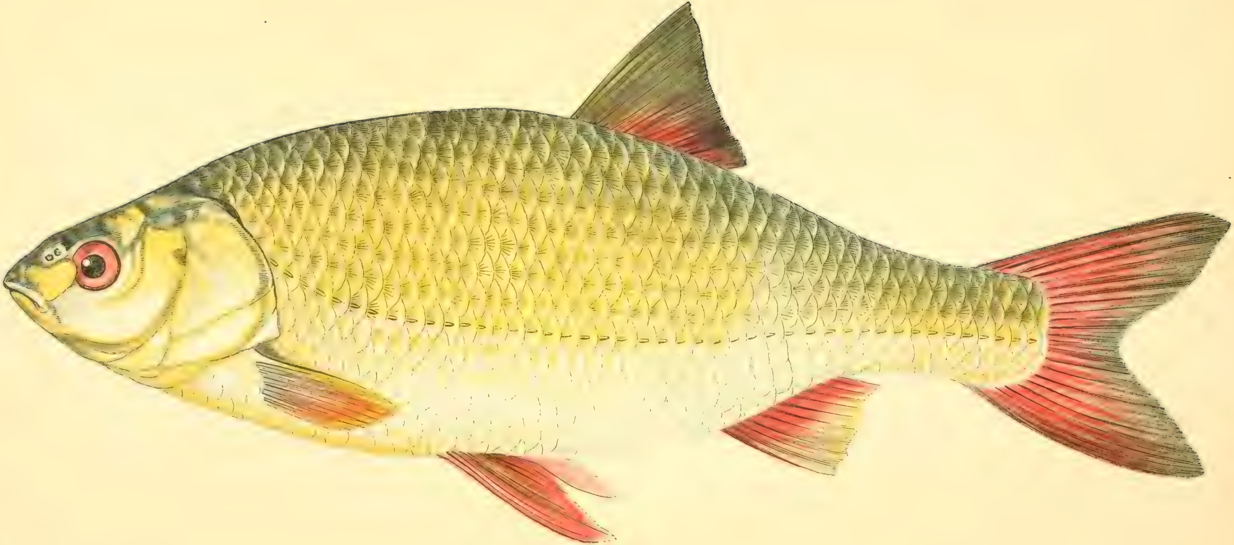
ROACH.

Rutilus or Rubellus,	Willoughby; p. 262. plate Q. 10.
Cyprinus rutilus,	Linnæus.
" "	Bloch; pl. 2. Donovan; pl. 67.
" "	Jenyns; Manual, p. 408.
Leuciscus rutilus,	Cuvier. Fleming; Br. Animals, p. 188.
" "	Yarrell: Br. Fishes, vol. i., p. 399.

The Roach is said to be the most prolific of this generally fertile family; and in spring or the early part of summer, Dr. Parnell says that immense shoals of them are observed to leave Loch Lomond, to ascend the different tributary streams for the purpose of depositing their spawn. During this period, which seldom lasts more than three days, the rivers are literally swarming with their numbers, giving a fine green appearance to the whole surface of the water. On this occasion every basket and net in the neighbouring villages is immediately put in requisition, and the thousands thus taken afford food to the villagers for a short period. It is the general habit of this fish to assemble in schools; but we have other evidence besides that of Dr. Parnell for the large numbers that gather together at this time of sexual migration; and Nilsson remarks that the males are observed to proceed from the lakes into the streams before the females. But it is necessary that these streams should contain a good supply of water, with sand or gravel at the bottom; and in these situations the young grow quickly, although their numbers must be considerably thinned by the depredations made on them by the Trouts, which watch the spawning, and devour the grains. The deeper pits of rivers are a favourite resort of the Roach, as well as the stiller waters of ponds and lakes; and in the Baltic they are sometimes found in bays near the land. We are not to conclude, however, that the Roach is able to live in the salt water of the sea, for we shall find occasion to remark, that in some situations of this northern sea, from the flow of rivers the water is rendered so fresh as to admit of living in it, some species that in other countries are confined to inland waters.

The Roach is generally distributed throughout Europe, except in the more southern parts. It is not known in Cornwall, and in Devonshire only in the lake called Slapton Ley, close to the south border of that county. Neither has it been found in Ireland; and the little esteem in which it is held as food has prevented its being conveyed into the many favourable situations for it which might be found in that country. But although in small regard for the table, it has been held in no small esteem by anglers, as affording lively sport from the eager way in which it takes the hook; in doing which it has obtained a character altogether opposite to that of the subtle Carp. "The Roche," says the Book of St. Albans, "is an easy fysshe to take;" but it is added, "yf he be fatte and pennyd thenne is he good meete." To the more ordinary baits this work closes with recommending the "fatte of bakon."

The Roach is usually about eight or ten inches in length, but sometimes it reaches fourteen or fifteen inches, with a depth of nearly the fourth part of the length. The gape is small; jaws without teeth; snout somewhat rounded. Outline of the body rising gently to the origin of the dorsal fin, which is above the root of the ventrals, and from thence sloping gradually to the tail. Scales large, easily lost; lateral line descending at first, and then proceeding nearer the ventral border than to the back. Eye moderate. The dorsal fin elevated, its first ray nearer the snout than to the tail; tail forked. Anal fin behind the termination of the dorsal, and the number of the fin rays equal in both, eleven or twelve in number; pectoral rounded, with sixteen rays; ventrals with nine; nineteen in the tail. Colour of the back greyish green, sometimes with a tinge of brown; sides whitish, with a tint of blue or reddish. Dorsal fin and tail dark; anal, ventral, and pectoral fins red; but Nilsson remarks that in the younger examples the eye is yellow instead of red, and the ventral and anal fins only reddish. The air-bladder and pharyngeal teeth possess the general characters of the family.



RUDD.

CXCII

RUDD.

REDEYE. FINSCALE.

Rutilus latior, vel Rubellio fluviatilis, Rudd,	Willoughby; p. 252, tab. Q. 3.
Cyprinus erythrophthalmus,	Linnæus.
Leuciscus erythrophthalmus,	Cuvier. Bloch, pl. 1.
Cyprinus erythrophthalmus,	Donovan, pl. 40.
" "	Fleming; Br. Animals, p. 188.
" "	Jenyns; Manual, p. 412.
" "	Yarrell; Br. F., vol. i, p. 412.

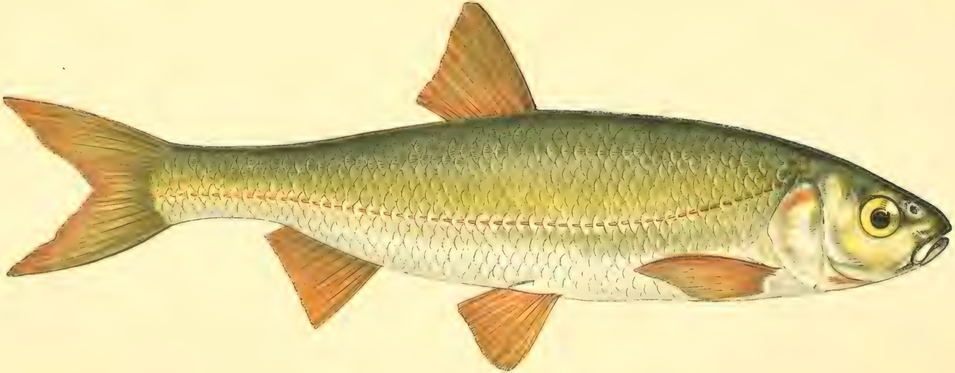
It appears that when Ray was engaged in editing the work of Willoughby, above referred to, he felt some doubt as regards a fish which was called Orfus in Germany—as to whether it might not be the same that in England was called Rudd or Redeye; and when afterwards he published his synopsis this doubt had become settled into a feeling of certainty. But this doubt or mistake of the illustrious Ray was carried further by Dr. Fleming; who not only represents the Rudd of Willoughby and Ray as the Orfus of Germany, but also that this Rudd is different from the species called the Redeye. The Orfus is truly a distinct species, but it has not been recognised in Britain.

For the most part the Rudd frequents the same natural districts as the Roach, where they are both found; and it is supposed to have much the same habits. But it is worthy of notice, and not easily accounted for, that the former fish is common in many parts of Ireland, while the true Roach is not known in that country, although supposed to be so because the Rudd has usurped the name. They do indeed bear some resemblance to each other; but the distinction of form between them may be made with little difficulty; and, if closely examined there is little doubt that the characteristic habits and appetites of each would also be found far from the same.

The food of the Rudd is worms, molluscous creatures of several kinds, and vegetables; but as it requires a good depth of water, with sheltering pools, it is not met with in districts where the flow of water is rapid and turbulent. Although, therefore, it is generally distributed through the more level counties of England, it is not a native of Cornwall, and I find it mentioned as uncertain in a list of the fishes found in the neighbourhood of Weymouth, kindly communicated by William Thompson, Esq., of that place, although the Roach is plentiful there. Nilsson observes that it is found in the south and middle portions of Scandinavia, where it appears to display more sociable habits than others of this family, so as to be found mingled with them, especially at the time of spawning. This function is entered upon in the beginning of summer, at which time the mole assumes a different appearance, by a particular roughness of the skin; and the spawn is shed among the weeds of the pools.

This fish is in considerable esteem for the table.

In spite of the dangers to which it is exposed, the Rudd is known to have reached the weight of two pounds; but our description is taken from much smaller examples; of which we select a couple in order to make a more definite comparison. Where the length was nine inches, the depth at the ventral fins was two inches and five eighths; the form rather stout, but compressed; snout gently rounded; gape narrow; under jaw a little the shortest; no teeth; eye moderate; nostrils in a depression. The outline ascends at first gently over the head towards the dorsal fin; in one specimen in a circular form, in another rising more suddenly behind the head. The body clothed with scales of moderate size; lateral line descending at first, and then near the lower border straight to the tail,—forty-three pores along this line. The dorsal fin is behind the line of the ventrals, and opposite the space between these and the anal, its first rays much the longest, becoming shorter gradually to the last; anal fin not so long as the dorsal; the tail forked. The colour in one example bluish green on the back, the sides tinged with blue, white below; the cheeks tinged with yellow; eyes bright red. All the fins tinged with red, the dorsal fin and tail dark near the border. In another example the general colour was brown, darker on the back; eye reddish brown; fins dull red, darker on the dorsal fin and tail.



DOBULE

CXCII

DOBULE.

GRESLING, of the Germans, which Artedi supposes to be the same with the Gudgeon.

Grislagine,	WILLOUGHBY; p. 263, pl. Q. 1.
Cyprinus Dobula and C. Grislagine,	LINNÆUS.
" "	BLOCH; Pl. 5.
Dobule Roach,	YARRELL; Br. Fishes, vol. i, p. 397.
Leuciscus Dobula,	CUVIER.
Cyprinus Dobula,	JENYNS; Manual, p. 409.

THE Dobule is so rare with us as to have been taken only once in Britain. We must, therefore, seek for its history, so far as it is known, from the continent of Europe; from whence it is fortunate that we are able to communicate some information not generally known among ourselves, but by which we may disentangle the confusion respecting it which has hitherto prevailed among naturalists. Artedi was the first to confound together two supposed species, which, according to the evidence of later authorities, are distinguished only by difference of age, or that small variation which is marked by a slight change in the number of rays in the fins; and in this he is followed by his friend Linnæus; who makes it the distinction between the *Cyprinus Dobula* and *C. Grislagine,* that the former is marked by ten of these rays in the dorsal and anal, while there are eleven in the *C. Grislagine;* although in the latter also Artedi assigns to the dorsal ten only.

We owe the correction of this mistake in the first place to Nilsson; who informs us that the example described by Mr. Yarrell under the name of Dobule Roach, and which is the *Cyprinus Dobula* of Bloch, was the early stage of the *Cyprinus Grislagine* of Linnæus; and this is also confirmed by Dr. Reisinger, in his Ichthyology of Hungary, who finds it in the Danube; and from him we copy the particulars which he gives of its food and breeding. He says that it frequents the clearer waters of the lakes and streams of that river, where there is a bottom of stones or gravel; and it feeds on worms and vegetables. The roe is of a greenish tinge, and is shed copiously in April and May. The flesh is white, soft, and full of the small bones common to this class of fishes.

The Dobule is strictly a fish of the north of Europe; and Nilsson says it is in Sweden confined to the streams and lakes in the middle and north of the province of Wermerland; and that it should travel to Britain is not the least remarkable portion of its history.

Mr. Yarrell himself took this example while engaged on the Thames in fishing for Whitebait with a net; and as it is not unlikely it may occur again, perhaps with some difference of appearance as regards age and growth, to enable observers to be certain of the species, we give descriptions as they are contained in the works of the writers we have mentioned; as also that of Mr. Yarrell in the fourteenth volume of the Linnean Transactions, to which are added some notes obtained from examination of what we have believed to be specimens of the same procured from the continent; but the latter are produced with the expression of some doubt. It is proper to add that the reviewer of Mr. Yarrell's work, in the first volume of the "Magazine of Zoology and Botany," on the authority of Dr. Parnell, informs us that this fish has also been caught in the Cumberland rivers; but no further particulars are given.

Nilsson describes this fish as measuring seven or eight inches, which answers to the length of the figure given by Ekstrom. The form lengthened, the height and length of the head one fifth of that of the body to the middle of the tail fin; the outline little arched, and not much compressed at the side. Nose prominent and blunt; mouth small. Lateral line a little bent, with about fifty mucous spores. Number of scales across the middle of the body twelve; the lateral line on the eighth scale. Anal fin with eleven rays, of which eight are branched. The colour brown above, silvery on the sides, white below. Dorsal fin the colour of the back; lower fins white, with a tinge of red, and sometimes all red.

The description of Dr. Reisinger is, that it measures eleven or twelve inches, with a weight from one to two pounds; the body lengthened, narrow, the back round; head blunt, roundish, broad above; nostrils above the line of the eyes; eyes large. Jaws with seven teeth in a double row; lower jaw a little the shortest. Lateral line curved downward, dotted with yellow points; (which may answer to what Willoughby says, that this line is "citrine," or faint yellow; but he adds that above it is a black stripe which passes from the eye to the tail, which is also represented in his figure.) Colour on the top of the head dark ash; eyes yellow, and in the young white or silvery, with a green spot above; the body above darkish green or yellow; below white, with a tint of blue. Scales of moderate size, spotted on their borders with black. Eye yellow, and in the younger examples, which are the *C. Grislagine* of Linnæus, this and the fins are white; in the older, or true *Dobula*, the dorsal is greenish, with eleven rays; the anal with eleven rays, and ventral with nine rays, both red; pectoral yellow, fifteen rays; caudal bluish, eighteen rays; the vertebræ forty.

Mr. Yarrell's example was only six inches and a half long, and, he says, being a young male fish, was slender in proportion to its length. The general colour dusky blue on the back, becoming brighter on the sides, silvery white beneath. The lateral line descending from the upper angle of the operculum takes a course along the side parallel to the curve of the belly; scales of moderate size; dorsal and caudal fins dusky brown; pectoral, ventral, and anal fins pale orange red; head rounded and blunt; upper jaw the longest, the under jaw shutting within it; nostrils pierced on the upper side of the head, rather nearer the eye than the upper lip; irides orange; cheeks and operculum silvery white; first ray of the dorsal fin rising half way between the anterior edge of the orbit of the eye and the end of the fleshy portion of the tail, the first ray short, the second the longest, the last ray double; of the anal fin also the first ray short and the last ray double. Number of fin rays—the dorsal nine, pectoral sixteen, ventral nine, anal ten, caudal twenty.

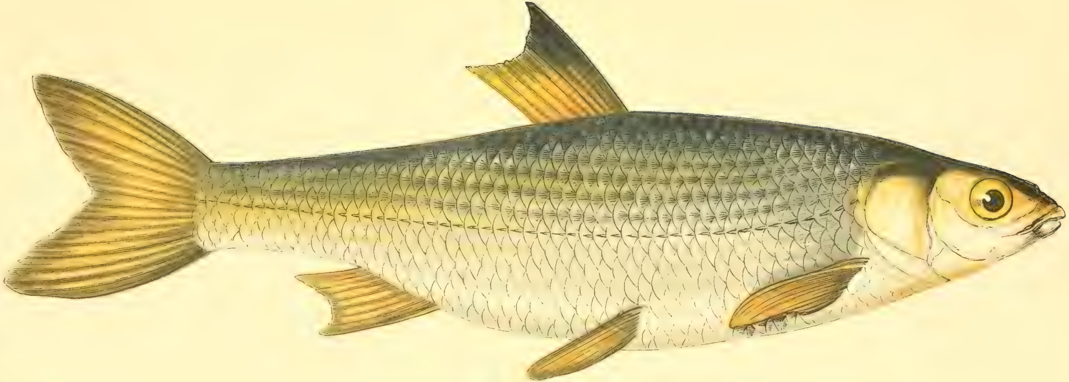
My own notes are, that the air-bladder is large, and of its two divisions the last fills a large portion of the cavity; bent forward and fastened near the vent; a small thread passes up to the base of the skull from this second division; so small that if not sought for it might have escaped observation.

DACE.

Dart,	WILLOUGHBY; p. 260, table Q. 10.
Cyprinus leuciscus,	LINNÆUS. BLOCH; pl. 97. DONOVAN; pl. 77.
" "	JENYNS; Manual, p. 410.
Leuciscus vulgaris,	CUVIER. FLEMING; Br. Animals, p. 187.
" "	YARRELL; Br. Fishes, vol. i, p. 404.

THE Dace is a lively and active fish, of sociable habits, and prefers a clear stream which flows over a clean gravelly bottom, with an abundant supply and depth of water. In the cold and darker seasons of the year it keeps close to the bottom, near shaded banks; but in bright and warm weather it rises to the surface, where it is ever ready to seize a fly, and, contrary to what is usual with others of this family, it will even leap after it in the manner of the common Trout. It is also freely ready to take a bait near the ground, and is there fished for with worms, maggots of several kinds, and artificial pastes. The time of spawning is in April and May, and in some rivers it increases abundantly; but from some cause not easily understood there are many streams in which it is not found. Thus it is not known in Ireland or Scotland; but in Cornwall, where no other of this genus besides it and the Minnow is a native, I have traced it to a branch at least of the Tamar which flows by the town of Launceston. It is only moderately valued as food. Walton sums up the character of this fish by saying—that Roach and Dace are much of a kind in matter of feeding, cunning, goodness, and usually in size.

This fish grows to the length of eight or nine inches, with proportions much resembling those of the Roach, the body not being so deep as in the Rudd; and it may be best described by comparison with the former fish. The under jaw



D.A.C

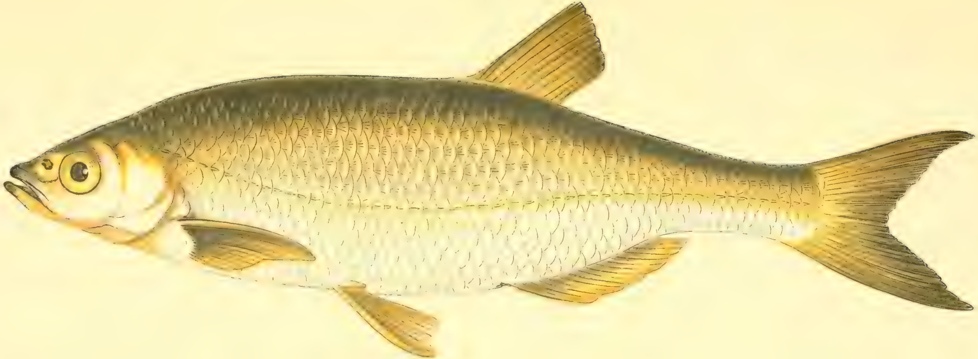
is very slightly the shortest; head rather small; eye moderately large. The outline rising very gradually to the dorsal fin, which is further back than in the Roach: its origin a little behind the root of the ventrals, and having nine rays, as have also the ventrals. The hindmost rays of the dorsal are long, although not equal in length to the first. Scales on the body rather smaller than on a Roach of the same size. Lateral line at first descending, and then straight to the tail, with fifty-two perforated scales; anal fin not greatly expanded, with ten rays; pectorals somewhat pointed, having seventeen rays; the tail forked, with twenty-one rays. The usual colour dark bluish, but sometimes brown; the sides lighter, with numerous lines running along the course of the scales. Dorsal fin yellowish, with a dark cloud on its anterior edge: the other fins pale.

BLEAK.

Bleak,	WILLOUGHBY; p. 263.
Cyprinus alburnus,	LINNÆUS. BLOCH; pl. 8.
" "	DONOVAN; pl. 18. JENYNS; Manual, p. 414.
Leuciscus alburnus,	CUVIER. FLEMING; Br. Animals, p. 188.
" "	YARRELL; Br. Fishes, vol. i, p. 419.

THE Bleak is a little lively and sportive fish, and is found in a large proportion of the rivers of the midland counties of England, in company with some others of the smaller species of this family, although it swims generally at a higher elevation in the water than they. But although perhaps as widely distributed as any of them, it is not a native of Ireland, and doubt exists as regards Scotland also. Sibbald is quoted by Fleming as assigning it to that portion of the United Kingdom, but it appears that the last named Scottish naturalist had not for himself a knowledge of the fact. It is not known in Cornwall or Devonshire; but is common on the Continent of Europe, and Nilsson says they abound in Sweden, as they do indeed in every situation in which they exist. We may conclude, therefore, that this fish is exceedingly prolific, as they are also social in a high degree; for they commonly keep in considerable schools, as they play on the surface or seek for food; and as they eagerly seize such insects and worms as come in their way, they offer easy sport to young anglers. The poet Ausonius notices this when he represents his Alburnos as affording "prædam puerilibus hamis,"—a prize to the hooks of little boys.

They shed their spawn early in June, in shallow water; and Nilsson observes that the oldest and largest are the first to perform this function. At this time, he says, the water seems alive with them; and the young ones are of quick growth from the egg. Contrary to what is known of several of the larger



[illegible]

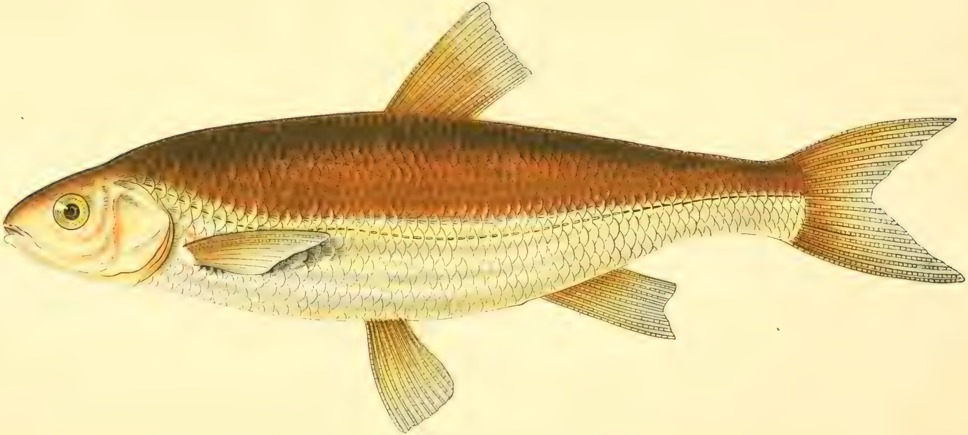
[illegible]

species of this family, the Bleak dies quickly when caught, and its flesh is quick to putrify.

As food this species is not much thought of, but a value has been attached to it from a remarkable invention of which it has been the subject, in the formation of fictitious pearls; the particulars of which I find related by Dr. Badham, in his "Fish Tattle," at greater length than by any other writer within my reach. It is the brilliant white lining on the inner surface of the scales that has been employed for this purpose; and the manufacture was first ventured on at Venice; where the true pearls were held in the highest value, as they were in Rome at the time when the last-named city was at the height of its greatness. The glittering pigment was dropped into thin hollow glass globules, where it adhered to the surface by means of a pearly varnish; and by the purchase of these it became easy for people of limited wealth to rival the pride of the higher and richer classes. This however was not long tolerated by the government, and the practice of thus imitating the true pearls was forbidden. But greater liberty was allowed in Paris, where the art was re-invented or introduced; and from whence it was conveyed into England and other countries; but where at present it appears to be generally neglected. In London we are told that the cruelty was practised of depriving these fish of their scales, and then turning them again into the river. We are not aware that fish so treated can ever regain their natural covering, so that if it were intended to catch and rob them a second time the effort would be unsuccessful.

This fish attains the length of about six inches, with a depth at the ventral fins of about one fourth of the length of the body, exclusive of the tail. The snout is somewhat pointed, and the lower jaw a little longer than the upper; the head small in proportion to the body. The lateral line gradually slopes down to about the origin of the ventral fins, and from thence backward low down and straight; scales easily removed. The dorsal fin is behind the middle of the body and above the vent; behind this fin and the anal the body becomes narrow to the tail.

As this species bears some resemblance to the Dace, a few notes of the difference between examples of each sort of equal size, laid side by side, will enable an observer to distinguish between them. Thus, the snout of the Dace is less sharp, and the lower jaw not so much protruded. The dorsal fin is somewhat nearer the tail in the Bleak, and when laid down the end of the dorsal is over the middle of the anal, where, as in the Dace, this fin reaches only to the root of the first ray of the anal. The upper rays of the pectoral fin reach almost to the ventrals, which is not the case in the Dace; and the ends of the divisions of the tail are much pointed. The colour of the Bleak is light brown or greenish, the sides and below brilliant white; the fins dusky. In the dorsal fin are ten or eleven rays, in the anal eighteen to twenty, pectoral sixteen, and in the ventral nine.



GRAINING

CXCVI

GRAINING.

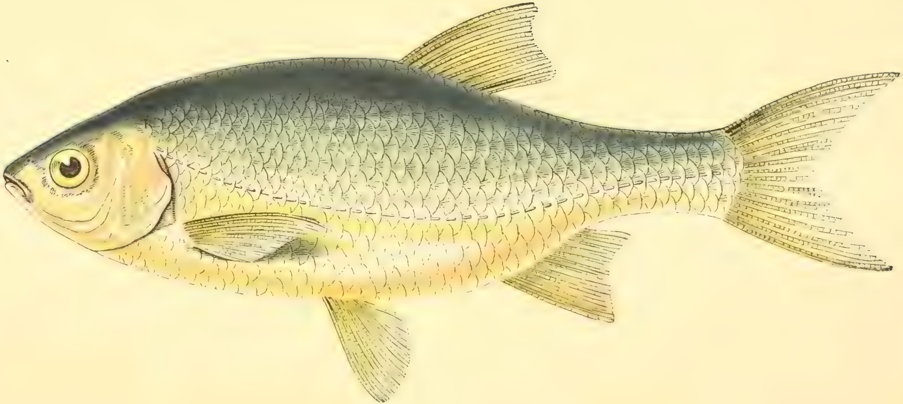
Leuciscus Lancastriensis,	YARRELL; Linn. Transactions, vol. 17, p. 6. British Fishes, vol. i, p. 406.
" "	JENYNS; Manual, p. 411.

THE earliest notice of this fish was given by Pennant, but perhaps from want of opportunity for examination it amounted to little more than assigning its provincial name and the situation in which it was found; and it remained for Mr. Yarrell to make us acquainted with the greater portion of what is known of its habits, and the marks by which it is distinguished from the kindred species. These particulars were originally contained in a paper printed in the Transactions of the Linnæan Society, as quoted above, and from which most of what we shall say of it is derived; to which I add that at the time when that paper appeared I was indebted to the kindness of that gentleman for coloured figures of this species, and also of the Blue Roach or Azurine, presently to be described.

But although the Graining had remained to so late a date unknown to naturalists, it is not scarce in its own limited districts in the northern counties of England. Indeed they are said to be abundant in the River Alt, and some other branches of the Mersey, where they afford much sport to fishermen, who fish for them in the same manner as they do for Trout. They take a fly as readily as they do a worm. Mr. Thompson also obtained examples of the Graining in the River Leam near Leamington, and at Guy's Cliff, in Warwickshire.

To prevent mistakes, as the examples believed to be of this species were of a different colour from what has been described by Mr. Yarrell, that of the body approaching more nearly to Shaw's description, we shall adhere closely to the description given by the former gentleman; adding only the remark, that the fishes of this family and of fresh-water generally are prone to change their colour when dead, and kept out of their element sufficiently long to be conveyed to a considerable distance; and that those I have seen were of a decidedly blue colour along the back. The Azurine also, as they came to my hands, were one of them drab coloured, and another a fine blue.

Mr. Yarrell's description is, that although similar to the Dace in shape, it is distinguished from it by being still more slender in form. The Graining has the top of the head, the back, and upper part of the sides of a pale drab colour, with bluish red, which is separated from the lighter coloured and inferior parts by a well-defined boundary line; the irides yellowish white; infraorbital portion of the head, operculum, and sides shining silvery white, tinged with yellow; all the fins pale yellowish white; the lateral line descending from the upper angle of the operculum by a gentle curve to the middle of the body, thence to the centre of the tail in a straight line; the scales of moderate size, marked with numerous concentric striæ and prominent radiating elevated ridges; whereas in the Dace the radiating lines on each scale are produced by grooved depressions. The central portion of each scale in the Graining is brighter than its sides, thus producing the appearance of shining longitudinal lines through the whole length of the body. The head is small, depressed, cheeks flat, line of the back but little elevated. The dorsal fin begins exactly half-way between the nose and the end of the fleshy portion of the tail; the first ray short, second longest, last double, nine in all. The mouth small, without teeth; eye large, nostrils nearer the eye than the nose, gill rays three; ventral fins on a vertical line but little in advance of the anterior portion of the dorsal fin, with ten rays; the anal fin commences, on a vertical line, immediately under the termination of the dorsal fin rays when that fin is depressed, and has eleven rays; the first of these rays short, the second longest, the last double. The fleshy portion of the tail long and slender, the rays deeply forked, nineteen in number. This fish does not often exceed the weight of half a pound.



AZURINE

CXCVII

AZURINE.

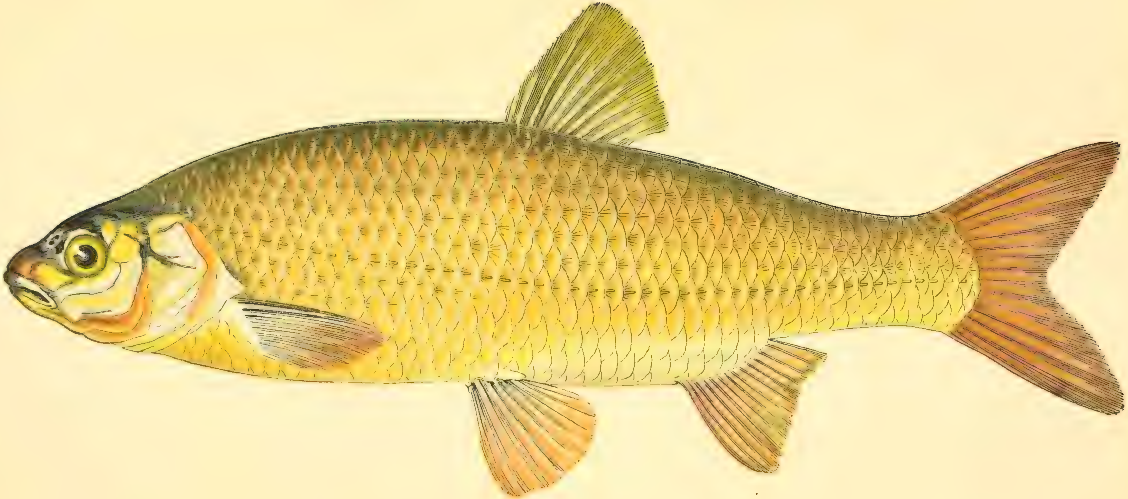
BLUE ROACH.

Leuciscus Cæruleus,	YARRELL; Trans. Linnean Soc., vol. 17, p. 8. British Fishes, vol. i, p. 416.
Cyprinus Cæruleus,	JENYNS; Manual, p. 413.

THE Azurine, or, as it is locally called, the Blue Roach, is so far a scarce fish that it was unknown to naturalists until it was examined by Mr. Yarrell; and so much concerning it as that gentleman was able to describe was inserted in a paper published in the Linnæan Transactions, as above referred to. It appears, however, according to Agassiz, to be an inhabitant of some of the lakes of Switzerland, and I have reason to believe that I have obtained it from some other river of England besides that which is mentioned by Mr. Yarrell, but of which I omitted to take a note. The only foundation for doubt is, that while the shape of the body and the situation of the dorsal fin is the same with Mr. Yarrell's figure, the rays of that fin do not exactly correspond; and after a long conveyance the colour of the back was dark umber, pale yellow on the sides, and cheeks yellow. It is deemed best therefore to have recourse to a coloured figure of this, which was a gift from its first describer at the time when it was announced as a newly-known species. Its habits are said to be much like those of the Chub; and especially it is highly retentive of life.

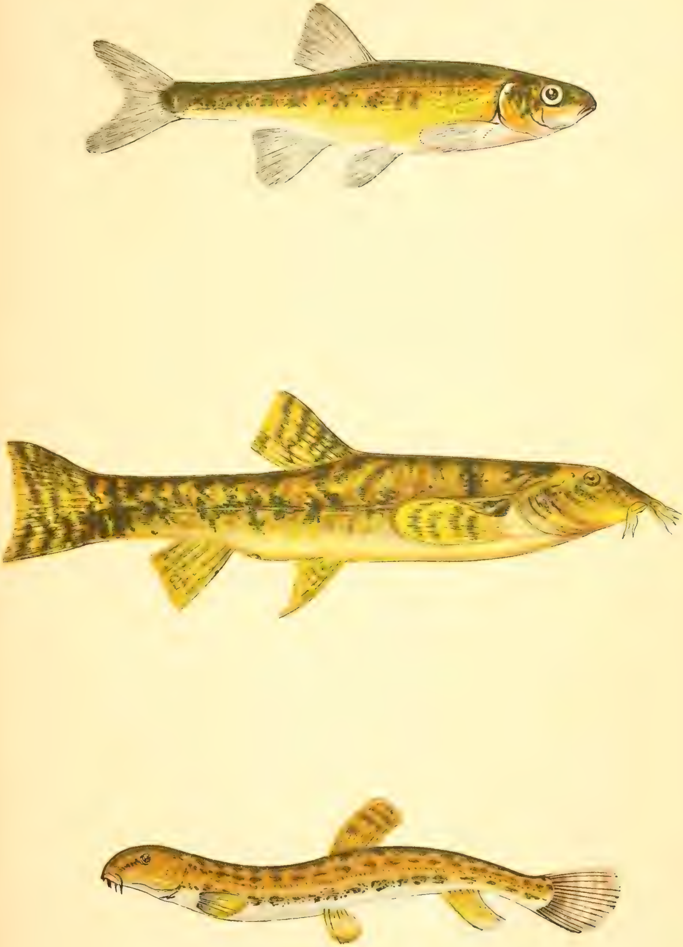
In shape this fish resembles the Rudd; but as regards colour it is distinguished by having the upper part of the head, the back, and sides, a slate blue, passing into silvery below, and both shining with a metallic lustre; whereas in the Rudd the lower part of the body is a golden yellow. In the last-named fish the fins are always of a fine vermilion colour, but in the Blue Roach they are white. The head is small and depressed, the back arched; dorsal fin far behind, beginning half-way between the posterior edge of the eye and the end of the scaly portion of the tail; half-way also between the first ray of the ventral and the anal fin, with nine or ten rays, the last double. The snout blunt, mouth small, without teeth. Pectoral fins long, reaching nearly to the origin of the ventrals, with sixteen rays. From the vent the body becomes much more slender; anal fin with twelve rays, the last ray double; caudal fin forked, with nineteen rays.

That nothing may be omitted as regards this little-known species, I add my notes as taken from an example in my possession.—The length four inches and three fourths, depth one inch and a fourth at some distance before the dorsal fin; the slope forward, beginning at the furthest third of the pectoral, and descending rapidly forward. Gape narrow, jaws nearly equal; eyes large and much in front. Body compressed, diminishing backward from the front of the dorsal and from the vent. The anal fin begins opposite the termination of the dorsal. Pectorals low; ventrals rather large; scales also large.



IDE.

CXCVIII



1. MINNOW.

2. LOACH. 3. SPINED LOACH.

CXCIX

MINNOW.

MINNIS. PINK.

Varius or Phoxinus lœvis,	JONSTON.
Phoxinus,	WILLOUGHBY; Pl. 28, 1, p. 268.
Cyprinus phoxinus,	LINNÆUS. DONOVAN; Pl. 60.
" "	JENYNS; Manual, p. 415.
Leuciscus phoxinus	CUVIER. BLOCH; p..8, f. 5.
" "	FLEMING; British Animals, p. 188.
" "	YARRELL; British Fishes, vol. i, p. 423.

IT appears from the writings of Jonston and Rondeletius that some other species has been confounded with our well-known Minnow, and that the *Phoxinus* and *Varius* of ancient authors are to be regarded as distinct; so that it becomes in some degree uncertain whether the remarks that will be extracted from Aristotle with reference to its habits, are applicable to one or the other; although indeed we suppose they may be more correctly referred to both. The *Phoxinus,* which is termed *Squamosus* or the Scaly, may belong to the genus *Leuciscus,* and has been supposed to be the fish denominated by Linnæus *Cyprinus bipunctatus;* but it is beyond doubt that the *Varius* of Rondeletius is our Minnow.

As its name implies, this fish is the smallest of the British species of this family. It appears also to be the most extensively distributed, and yet it is remarkable that it was not originally a native of the Irish rivers; its introduction into that island not having taken place at a much earlier date than the beginning of the present (nineteenth) century, and it is not, even at this time, to be found in many situations that appear well fitted to its nature. But where it has been conveyed it multiplies as freely as in England. In Scotland also

IDE.

Cyprinus idus,	Linnæus.
Leuciscus idus,	Cuvier. Bloch; pl. 36.
" "	Yarrell; Br. Fishes, vol. i, p. 395.

The only authority for placing this species among British fishes is Stewart, in his "Elements," etc., who says that an example was obtained from the mouth of the Nith by Dr. Walker, but it has not since been recognised, and its claims therefore must be regarded as doubtful. It is minutely described by Artedi under its Swedish name of Id, and also by Ekstrom, who says it is common in Scandinavia, as far north as Lapland. It also wanders into the bays of the Baltic Sea, where the water is known to be much more fresh than in the open ocean. Several of the fishes of this family do so, and it is just possible that this species may have done the same.

it is common, and in some districts of this portion of Britain it is the only one of the family of Carps which inhabits the rivers.

We learn that it is known in Sweden and Norway, and supposing it to be the *Phoxinus* mentioned by Aristotle and Pliny, it occurs in Macedonia or Greece; although it is not recognised in Italy by Risso. In some of the smaller streams in Cornwall it is not found; but in many of the isolated ponds or pools on the wilder downs of that county they abound; although it seems difficult to imagine in what manner they can have been conveyed thither; and the ponds themselves are distant from any river, so that they appear to be supplied with water only from the draining of the surrounding soil or the occasional fall of rain. But, besides the Minnows there is found in these solitary ponds a fine species of Trout, which nearly resembles that of the Loe Pool, in the same county; and to these the Minnow can furnish a sufficient supply of food, while the manner in which itself manages to obtain subsistence has escaped observation. These pools must be of ancient date, but in appearance they are nothing more than the excavations made by miners in remote times in their search for tin.

In the flowing streams inhabited by this fish it is necessary there should be some deeper recesses into which it may retire from the influence of the colder seasons, to which it is highly sensitive; but in summer it is active and frolicsome in shallower water over a gravelly bottom; where numerous companies are seen enjoying themselves in sport, unconscious of the danger which besets them from ravenous enemies, which rush suddenly among them, while such as are so fortunate as to escape are dispersed in all directions. Perhaps the Trout is their most destructive foe, and no more enticing bait can be employed to entice that fish to its own destruction; but indeed there are few of the predaceous fishes which inhabit fresh water that do not prove themselves formidable enemies to this little fish; for in the earliest stage of its existence there are larvæ of insects which prey upon it; so that if it were not exceedingly prolific, the race itself would be in danger of becoming extinct.

But to counteract this extremity of hazard, Aristotle has remarked that the *Phoxinus* begins to breed almost as soon as it has come into existence, which is only an exaggeration of what belongs to fishes in general; for, contrary to what takes place in creatures that are higher in the scale of nature, almost all fishes breed long before they have reached their full extent of growth. Yet among Minnows there are found more males than females, and the season of spawning, which is in the middle of summer, appears to be short for each individual; although an observation of Aristotle, which appears to be confirmed by the experience of others, is sufficient to shew that the younger fishes may have produced a progeny sufficient to provide a second growth before the expiration of the same season. As the colder weather approaches they certainly cease to breed.

The spawn is deposited in sandy ground, and in a very short time the young escape from the egg; but at this early stage of existence, as enemies are numerous, they are said to seek concealment from danger by burying themselves in the sand. As it is known also that they are not usually to be discovered in the colder months of the year, it is to be supposed that at this season some similar mode of concealment or shelter is again resorted to.

Naturally the Minnow is a timid fish; as it may well be where every inhabitant of the stream is a dangerous enemy. But it may be rendered tame without difficulty, and in a tank it will take food from the hand, and even attend on the motions of a friend. In the river it readily seizes a bait, and will even hold it so fast with the jaws as to suffer itself to be thus lifted out of the water. And when not disturbed it is amusing to see them assemble in order to devour some dead animal substance, which may even chance to be the body of one of their own species. They arrange themselves in the form of a ring, which has been compared to that formed by the petals of a flower, with their heads lower than the level of their bodies; and in this situation no one jostles another. But however peaceable among themselves, the circle must not be broken into by a stranger; for on the approach of such the most powerful of the company will quit his station to drive him away; while his place is kept vacant by his companions until his return to the feast.

The Minnow seldom exceeds three inches in length; the shape solid and robust, but lengthened in proportion to the depth, and moderately compressed. The snout rounded, under jaw a little the shortest, nostrils large and open; eyes large; summit of the head broad, body rounded over the back; scales scarcely perceptible. The first ray of the dorsal fin at the middle, as measured from the snout to the fork of the tail, with nine rays, but also with a first ray very short, making ten; the last two from one root. Anal fin beginning about opposite the last ray of the dorsal, with seven rays; tail wide forked, with nineteen rays; pectoral pointed; ventral nine rays. Colour of the top of the head and back dark green, with darker bars, plainly visible in some, less so in others; a yellow line from the upper part of the gill-covers to the tail; cheeks yellow; faint yellow or whitish on the belly; fins generally pale yellow; a dark spot at the root of the tail. In some specimens a dark brown line from the eye to the mystache; and in the breeding season the under parts a lively pink. The breadth across the head with a narrowing towards the mouth is the best proof that this fish is the true *Phoxinus* of Aristotle; whose name of it, as signifying "formed like a top," is applicable to such a shape.

COBITIS.

The head small; mouth without teeth, but with barbs on the lips. Body lengthened, with small scales. Three rays in the gill membrane, the aperture small; ventral fins far behind, and above them a single small dorsal fin. Abdominal fishes.

This family, which with us bears the name of Loach, is aberrant from that of the true Carps, and appears to make an approach to that of *Silurus*, thus uniting together species which in their general aspect, as well as in habits, appear at first sight to have little in common. Besides the presence of barbels at the mouth, which assimilates them generally to the true Carps, Barbel, and Gudgeon, they also possess the strongly-toothed pharyngeal bones, and an air-bladder separated into two lobes; which latter is indeed scarcely to be discerned, because besides its being of very small size, it is enclosed within a double bony case formed by the third and fourth vertebræ, whereby it is kept almost concealed from view. It is placed immediately over the entrance of the mouth from the gullet, and was only discovered by the skilful dissection of an anatomist; and its office appears to be more closely connected with the organ of hearing than with the more ordinary function of suspending the body in water. It appears from an observation by Mr. Maclelland in the "Asiatic Researches," that the bones of the ear discovered by Professor Weber, as referred to by Blumenbach and Professor Owen, (which in some of this family connect the air-bladder with the organ of hearing in the brain,) in the Loaches occupy the situation of this doubly-lobed vessel; and it points out the near connection between the *Siluridæ* and the Loaches, that the air-vessel of the former is situated in the same relative situation.

This family of Loaches is also distinguished by an abundant supply of mucus on the skin, secreted from innumerable but obscure sources, which are not confined to the lateral line, as in the generality of the *Cyprinidæ*, but are scattered over the whole surface; and the use of which is that it not only renders them more difficult to be laid hold of, but also answers an important purpose in the animal œconomy by preventing the escape of fluids necessary to their existence; a remark which will apply to many other fishes besides the Loaches. From experiments made by Dr. W. F. Edwards, brother of Dr. Milne Edwards, it has been found that when a Chub and Gudgeon had been wiped dry and weighed alive, although their gills continued to beat until they were dead, yet by that time they had lost by evaporation, the one a fifteenth, and the other a fourteenth of their whole weight; and other species suffered in about the same proportion. But an example in which the body was immersed while the head and gills were exposed to the air, remained alive for nine hours and twenty minutes; and how long the Carp will continue alive, and even increase in bulk, when wholly enclosed in wet moss, or frequently dipped in water has been already noticed.

LOACH.

Cobitis fluviatilis barbatula,		Willoughby; p. 265, Table Q. 8.
"	*barbatula,*	Linnæus. Cuvier. Bloch; Pl. 31, f. 3.
"	"	Donovan; Pl. 22.
"	"	Fleming; British Animals, p. 189.
"	"	Jenyns; Manual, p. 416.
"	"	Yarrell; Br. Fishes, vol. i, p. 427. It has been supposed to be the Redo of the Poet Ausonius.

The Loach is generally distributed throughout the United Kingdom, and over a large part of the continent of Europe, up to the far north of Scandinavia; but it does not appear to exist in warmer countries, although several other species of the same family are known in India. But even among ourselves it does not inhabit all the streams which might be supposed suited to its nature; and whilst a preference is given to clear water which flows with some degree of rapidity, it is most frequently met with in the narrower branches of a river rather than in the wider and deeper stream. It keeps chiefly at the bottom, where it lies concealed beneath a stone, or resting at ease upon it, waiting for prey with the barbs which encircle its mouth extended; and the quick sensibility with which they are endowed, may be judged from the nerves with which they are furnished, and which are of larger size than those which provide the eyes with sight. Soon after these nerves have come from the brain, at about the hindmost corner of the eye, each of them divides into a pair of branches, the lowermost of which proceeds to the corner of the mouth, while the upper goes to the snout, and probably to the barbs. And that the nostrils also are possessed of acute sensibility is proved in that when the experiment has been made, this fish has been seen to have followed its food by the scent, so as to have discovered it when intentionally concealed from the mere influence of sight and feeling.

But it is for the most part only by daylight that the Loach reclines listlessly at the bottom, concealed or in an apparently waiting posture; for it is a nocturnal fish, and when darkness has concealed its movements, it assumes habits of active energy, whether in seeking its prey or escaping enemies; and of the approach of the latter, or the feeling of any unusual motion, its instinctive watchfulness presently puts it on its guard. When kept in a tank its boisterous attempts to extend its rambles have been so powerful and persevering as to be heard far off, and have caused it to throw itself over the wall of its prison; and this is especially the case at the approach of or during remarkable changes of wind and weather. Nor ought this sensibility to atmospheric changes excite surprise; since, besides the experience of anglers in the river, fishermen on the ocean know that at considerable depths many sorts of fish are quickly sensible of the same influence, as displayed in their motions of activity and appetite; and it is only in the supposition of the sensition excited in them by electric changes in the atmosphere that this can be accounted for. This fish is also observed to ascend from the bottom to the surface, and again to descend many times in succession; and on these occasions it is probable that it takes in and swallows portions of air; not, however, into its diminutive air-bladder, but into its stomach; from which it passes through the bowel to be discharged in the form of carbonic gas; in which proceeding it has been remarked that the intestine appears to perform a function which in creatures of the land is more particularly the duty of the lungs.

The Loach will take a bait, and notwithstanding its small size it has been pronounced delicious food; so that for the use of the table in some parts of Europe it is carried to market alive. And connected with this, as already, in speaking of the Barbel, we have referred to a practice in remote times of eating it uncooked; in some parts of our own country a great stretch of this morbid appetite is said to be sometimes indulged in, by swallowing the Loach while still alive. But when this sort of mistaken craving is indulged in, the devourer should at least be cautioned to observe the advice of Rondeletius, in not mistaking the Armed Loach, next to be described, for the smooth-cheeked species; and thereby become liable to the penalty of suffering a laceration of his throat, as the struggling victim may be urging his passage into his stomach.

This fish sheds its spawn in April and May.

It rarely attains to five inches in length; the head rather depressed, sloping from the eyes, which are small, to the snout; the front moderately rounded. The mouth arched, gape small, jaws weak, upper lip with six barbs, a pair of which are at the corners of the mouth. The body lengthened, round at first, afterwards compressed, slightly deeper at the origin of the dorsal fin, but behind this nearly equal to the tail. Lateral line nearly straight. The surface covered with slime; scales little perceptible, not in regular order, and none on the head or throat. Origin of the single dorsal fin about half-way between the snout and origin of the caudal fin, with nine or ten rays. This fin is immediately above the ventrals, and ends before the origin of the anal; which last fin is by Mr. Yarrell described as having six rays, and by Nilsson as furnished with nine. The ventrals have nine; pectorals large, round, with thirteen rays; the tail wider than long, straight or round. The colour is prettily varied;—the back more or less a darkish green, with dark brown blotches and stripes; below pale yellowish white. All the fins have a tendency to yellow; dorsal and caudal, and partly the pectoral, with stripes of brown.

BOTIA.

This genus was constituted by Dr. John Edward Gray for the reception of those Loaches which possess a spine on the fore part of the face, a little behind the nostrils. The other characters are the same as in the genus *Cobitis.*

Several of these fishes are thus armed in India, but there is only one in our own country.

SPINED LOACH.

Cobitis Tænia,	Linnæus. Cuvier. Bloch; Pl. 31, f. 2.
" "	Jenyns; Manual, p. 417.
Gobitis Tænia,	Fleming; British Animals, p. 189.
Botia Tænia,	Yarrell; British Fishes, vol. i, p. 432.

Among the older naturalists there is much confusion in distinguishing this species from the more common Loach; and indeed so far as regards their habits little is known of the particulars in which they differ; the principal being that this Spined Loach keeps in more muddy places, and is more inclined to shelter itself within the soil. It is also more retentive of life. Although it is well known on the continent, it has not yet been discovered in Ireland; and in Britain it has been recorded in only a few rivers, although perhaps on closer search it may be found in several others. The counties of Nottingham, Wilts., Cambridge, Warwick, and, I believe, Gloucester, are mentioned as containing this fish, but it seems not to find a home in any very rapid streams.

The use of the remarkable bifid spine on the superior portion of the face, which constitutes the principal generic character, and seems to be moveable at the will of the fish, is uncertain; but perhaps it may be employed in the way of defence after the manner of the more powerful instrument that arms the posterior portion of the head of the Weever. A figure of this fish obtained by myself from nature appears to be too small to afford a satisfactory likeness; and therefore we borrow a copy from Bloch, of what appears to be the usual size of the fish. Nor does a lengthened description appear necessary in order to distinguish it from the unarmed species already described. It is relatively of a more slender form, as is implied in the trivial name of *Tœnia*, or the Tape; but the situation of the fins and barbs is the same. The fins are a little smaller and narrower, the barbs scarcely so long, and the snout is slightly more projected. The sharp and doubly-pointed spine, which forms the principal character of this fish, is a ready mark of distinction, but it is to be remarked that it may lie so closely pressed down as not to be readily discerned.

Doubly-pointed spine.

SILURUS.

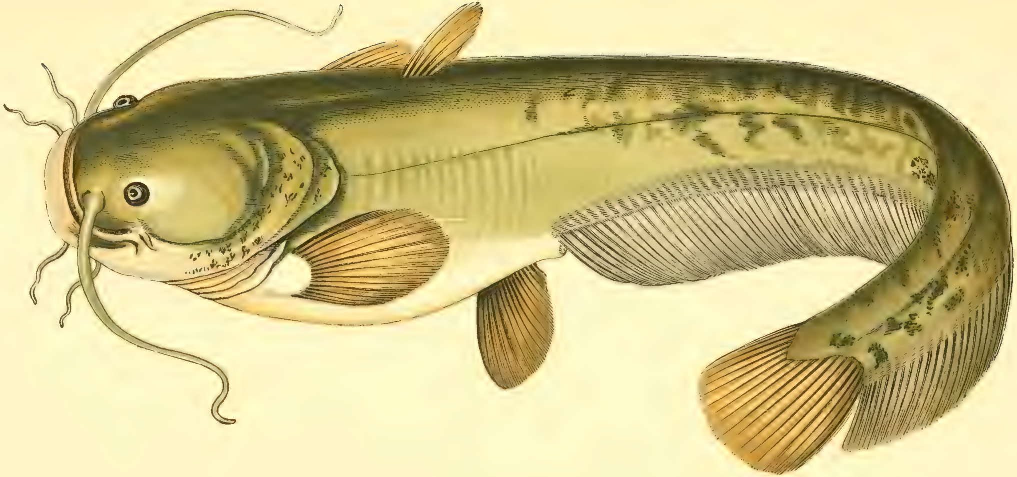
The body depressed and rounded on its anterior part, compressed behind; mouth wide, with several long barbs; gill membrane with rays not less than four; no scales on the head or body. A single narrow dorsal fin; the first ray of the pectoral armed with a strong spine; caudal fin separate. Abdominal fishes.

SHEATFISH.

SLY SILURUS.

Mustela barbata,	Jonston; Table 28, f. 7.
" "	Willoughby; p. 128, plate H. 5.
Silurus glanis,	Linnæus. Cuvier. Bloch; pl. 34.
" "	Yarrell; Br. Fishes, vol. i, p. 461.
The Wels,	Dr. Gunther; Fisherman's Magazine, No. 8, p. 365.

There appears little reason to doubt that the Silurus of Pliny, (B. 9, c. 15.) and consequently the Glanis of Aristotle, is the same with the *Silurus glanis* of Linnæus; but it is still uncertain whether it has ever been found in the British Islands. From the enormous size it sometimes attains it could not have remained with us without having been discovered, and therefore if found at all, it could only have been as a wanderer from the Continent of Europe, in the larger rivers of which it is known, although not in abundance, for it is said to be not exceedingly prolific. In the Danube, and the larger rivers of the north of Europe, it is well known; but it is more rare in Sweden, although it is met with even in Norway. According to Nilsson, in these northern countries it never reaches the same size as in Germany. Pliny says it is a fish of the Nile, and also of a lake out of which the Nile flows: a remarkable



SHEATFISH.

CC

anticipation of modern discovery; and it is also found in some other rivers of Africa, and in Asia. But the question arises whether this fish is capable of living for a short time in the open sea; and it scarcely amounts to an answer to this, when it is said that it has been occasionally found in the Baltic, for it is known that the water of that inland sea is much less salt than that of the ocean, and in its upper part it is almost entirely fresh.

It is affirmed, however, that the Sheatfish has been taken in an Irish river; but the example was not seen by a scientific naturalist, nor was a figure of it drawn; and therefore it is for the assistance of future observers that we extract what Mr. Thompson has recorded of the facts of the case. "That this species has in a single instance been taken in Ireland I am disposed to believe, on the following testimony:—On inquiry (October, 1840,) of William Blair, who has for many years been fisherman, etc., at Florence Court, whether he had ever met with any rare fish, he described an extraordinary one, of which he could never learn the name, that he took twelve or thirteen years ago in a tributary of the Shannon, near its source, and about three miles above Lough Allen. His description was so graphic and particular that Lord Enniskillen, on hearing it, immediately suggested its applicability to the Silurus; and on Yarrell's figure being shewn to the intelligent captor of the specimen, he at once identified it as in all respects representing his fish, except in the head and mouth not being large enough. Professor Agassiz, who was present, on being appealed to, stated that these parts were certainly not represented of sufficient size in the figure. The fish was seen struggling in a pool in the river after a flood, and "with the long worm-like feelers from its mouth;" and its general appearance was looked upon as so hideous, that the persons who first saw it were afraid to touch it. The specimen was at least two feet and a half in length, and eight or nine pounds in weight. Although unfortunately lost to science, it for two or three years—or until the skeleton fell to pieces—adorned a bush near the scene of its death. The species was not known as an inhabitant of any of the neighbouring waters by the persons of the district. The distribution of the *Silurus glanis* on the Continent of Europe is somewhat anomalous, as

I learn from M. Agassiz. In Central Europe it is found in the lakes of Neuchatel, Bienne, and Morat only: in no other lakes or rivers connected with the Rhine does it occur. It inhabits the rivers flowing into the Baltic and Black Sea."—("Natural History of Ireland," vol. iv.)

The ancients appear to have paid much attention to the habits of this fish, which they called Glanis or Lagnis. Aristotle says that the female altogether neglects the care of her spawn and the young, but that the male watches over and protects them; and that in about forty or fifty days they are able to shift for themselves. He adds, that this fish is stupified with loud thunder, and that as food the female is better than the male; both are to be rejected when the female is large with spawn.

Whether this fish was ever in remote times an inhabitant of English rivers may also be regarded as uncertain: but Mr. Higgins informs me that he found undoubted relics of the pectoral defence bone of this fish, in a bed of clay, under a layer of peat, at Leasowe, in Cheshire, while engaged in searching for fossil remains. I find also, in an extract from Lloyd's "Scandinavian Adventures," that through the indefatigable exertions of Mr. George Berney, of Morton, in Norfolk, "the Silurus was last year (1853) introduced into England, and consequently is now included in our fauna;" but how far this attempt has been successful does not appear. To assist future observers the likeness of this fish is copied from Bloch, and our description chiefly from Willoughby, with additions from Olaus Wormius and Nilsson, the former of whom has represented its character as being slow in its actions, sly and all-devouring; and it is said that it has even been known to swallow a child of the age of seven or eight years.

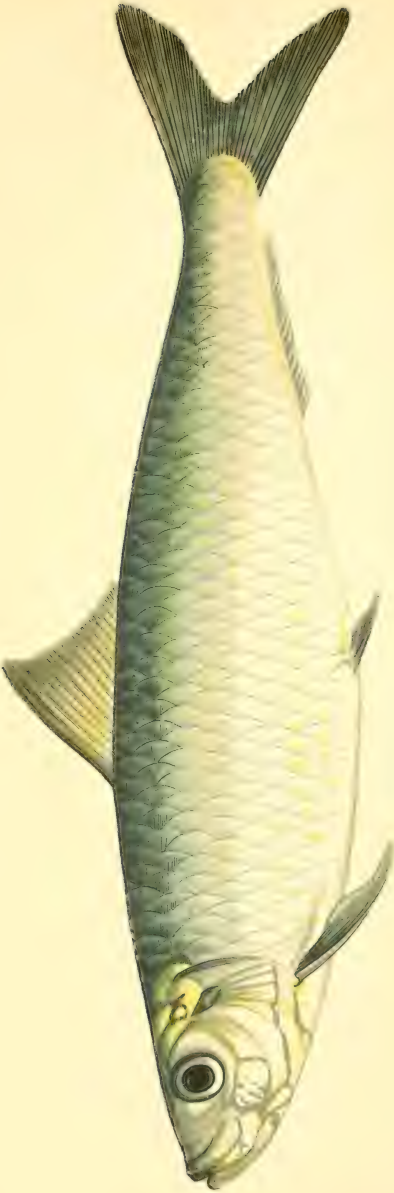
It has been known to attain the length of ten or eleven feet, and is recorded to have weighed one hundred and fifty-six pounds, and, according to Bloch, it has even reached the enormous weight of seven hundred and fifty pounds, after the entrails had been removed; but it is said by Nilsson to be rarely longer (in Sweden) than four feet, with a weight of fifty pounds. The head is flattened and wide, the body rounded on the fore part, compressed towards the tail; belly tumid, and capable of great distension; the mouth wide; gape large; jaws rough with teeth; on each corner of the upper lip a long stout barb, which in the younger examples reaches as far back as the vent; below the lower jaw four barbs of less dimensions. Eyes small, protruding; gill-openings large; the skin smooth and tough. A single narrow dorsal fin, situated above the pectorals, with from three to five rays; pectorals round, armed in front with a firm bone that is toothed on its hindward border, eighteen rays; ventral fin with sixteen; the tail round, with eighteen rays. The colour above dark brown with a tint of green, more or less spotted with black; the belly yellowish, dusky and mottled. The air-bladder is divided through its length.

CLUPEIDÆ.

THE HERRING FAMILY.

THE character is that the upper jaw has on each side a long, wide, slightly bent mystache, or free maxillary bone, which is not furnished with teeth. The body covered with scales; the belly ridged, with pointed scales differing from those on the body; gill membrane with eight rays. A single dorsal fin; the tail forked.

In their general appearance the fishes of this family bear much resemblance to the Lake or River Breams; but they differ in the form and dimensions of the mystache, and especially in the saw-like keel of the belly. Inwardly also the characteristic pharyngeal bones in the family of *Cyprinidæ* are lost; and the *Clupeidæ* for the most part are without any, or they are so faintly marked as scarcely to be discerned. The remarkable shape of the air-bladder is also exchanged for a long and narrow tube, both ends of which are drawn out into a thread, the hindmost of which in the Herring extends to the vent. Of all fishes they have the most slender and numerous bones; so that along the lower part of the body the ribs reach to the forked scales, by the aid of which the muscles of the sides become more firmly sustained; and there is also a double row of hair-like bones between these ribs and the upright processes of the vertebræ, by the help of which the actions of the muscles of the back are rendered more energetic. They are abdominal fishes.



CLUPEA.

Cuvier assigns to a separate genus the species of this family which have the maxillary bones or mystache arched above, and capable of being divided lengthwise into separate pieces, and by the aid of which the gape can be considerably modified. From the kindred genus *Alosa* it is distinguished by the absence of a decided cleft in front of the upper jaw, which is caused by a separation of the intermaxillary bones. From the genus *Encrasicholus* it is separated by the projecting snout and long cleft of the mouth of the latter.

PILCHARD.

Harengus minor, sive Pilchardus,	Willoughby; p. 223, pl. P. 1.
Clupea pilchardus,	Cuvier. Donovan; pl. 69.
" "	Fleming; Br. Animals, p. 182.
" "	Jenyns; Manual, p. 436.
" "	Yarrell; Br. Fishes, vol. ii, p. 169.
" "	Turton's Linnæus. The Swedish naturalist confounded this fish with the Sprat.

The Pilchard is one of the commonest fishes in the western districts of England and the south of Ireland, and, as regards numbers, the most abundant in its season; but its range is not extensive, and it is only as a rare wanderer that it is known eastward beyond Devonshire, or on the north beyond the Bristol Channel. But we read of the taking of a considerable school in the year 1722, so far up the River Dart as Totness Bridge, whither they had been driven by a herd of Porpoises; and Dale, who wrote a history of Harwich, reports their having been caught on the coast of Essex. Dr. Parnell is also a witness to the occurrence of this fish in the Firth of Forth, and its Scottish name of Garvie Herring is proof of at least its casual occurrence in other parts of that kingdom.

Of its distribution in the south of Europe we are not able to say anything, until it is rendered certain whether the Pilchard be the same fish with the Sardine of the coasts of Spain and the Mediterranean: a question concerning which we will offer a few remarks when we enter on a description of the fish as it occurs in our own seas. But it is to the coast of Cornwall, and the shores of Devon bordering on that county, that we must look for the history of this fish, and the value of its fishery; and if we do not refer also to the south of Ireland for the same purpose, it is because the subject has not been there attended to in the manner its importance demands. It is in the districts just named that the Pilchard is to be regarded as a native, for it is there they propagate, and may be found at all seasons. There also they perform their migratory motions, which, with an approach to regularity, are yet attended with such variety as to stamp their habits and motions with the character of capriciousness, and which belongs also to the other species of this family in such a manner as to constitute for all of them a common likeness. The same remark was made so long ago as in the time of the poet Oppian, who, under the name of Chalkis, refers to a fish which his translator supposes to be no other than our common Pilchard.

"Pilchards and Shads in shoals together keep,
The numerous fry disturbs the mantling deep;
No home they know, nor can confinement love,
But, fond of hourly change, unsettled rove;
Now choose the rocks, now seek the wider seas:
No place can long the restless wanderers please.
They soon grow weary when they once enjoy;
And pleasure will, as soon as tasted, cloy."

And thus it happens, that although it is known when the season of the fish's arrival is come, so little is certain of the time when the schools will approach a particular district, that the fishermen are kept in daily suspense, and their individual success from year to year becomes a matter of great uncertainty,

The usual course of the movements of the Pilchards is that they seek the deeper water of the nearer portion of the Atlantic in the colder season of the year; and that they are then at the bottom is often known by their being found in the stomachs of the larger fishes which are caught with lines at that season. Large numbers have then gone beyond the reach of the longest lines; for they are seen to rise to the surface when the season changes, at a still more considerable distance west or south of the Scilly Islands. But such seclusion is not always sought; and it is in our notes that schools (in one instance believed to contain a thousand hogsheads) have come within the reach of drift-nets, and even of seans, in January, February, and March. Usually, however, at this season they are more scattered, or in smaller companies, and it is supposed that their subordinate motions are by drawing nearer the land by day, and passing into deeper water at night. The reason of these occasional early assemblages may be that the time of spawning in the spring has become permanently early, for it is far from an unusual occurrence that many sorts of fishes shall anticipate or delay the more ordinary seasons of their race; but in April and May they are habitually prepared to shed their spawn, which they now do at a further distance from land, and over deeper water than is the case at the warmer season of autumn, when again, early or later, they perform the same function, although we do not feel assured that they are the same fishes which thus perform the duty of procreation on both occasions. The number of males usually exceeds that of females, and sometimes they do so to a large extent; but mingled with them are many that have no enlargement of the milt or roe, and some also which appear to be of both sexes united.

I have reason to suppose that the spawn is shed at the surface, and mingled with it a large quantity of tenacious mucus, in which it is kept floating while it is obtaining the vivifying influence of the light and warmth of the sun, by the influence of which the development is considerably hastened, as we know to be the case with many other kinds of fish. My notes on this subject are, that presently after spawning, a sheet of jelly, enclosing myriads of enlarging grains of spawn, has been seen to extend several miles in length, and a mile or more in breadth, over the surface of the sea, and which has been of the thickness of brown paper, and so tough as not to be readily torn in pieces. In about a couple of days this connecting mucus became decomposed, and the ova then sunk to the bottom of the vessel in which they had been placed; but, being thus removed from their natural situation, they did not pass through a further process of development.

There seems to be no reason to doubt that these fishes require two, and probably three years to enable them to attain their full growth; and the occasional preponderancy of numbers of the young above the old will tend to explain some unusual circumstances which at times have occurred to the great disappointment of the fishermen, and which otherwise appear unaccountable. Thus the fish which may be caught at one time will be of such diversity of size as to imply a great difference of age in the individuals; but for several years in the early part of the present century, the larger portion of the schools consisted of fish of such diminutive size as to be able to pass through the small meshes of the seans, which, therefore, were eminently unsuccessful. At this time the larger fish must have taken an unusual direction, and the difference of numbers that were caught under these circumstances was so great, that, whereas the average quantity supplied for exportation in each year has been given, by good authority, as thirty thousand hogsheads of fifty gallons each, in the year 1829 there were only five hundred hogsheads.

That a capricious search after food may exercise an influence on the wanderings of the Pilchard is probable; but some uncertainty still exists concerning the nature of its usual sustenance, and it is only by supposing it to vary at different times that we can venture to account for the considerable difference which exists in its health and condition at different times, and especially at the seasons of its spawning in the spring and autumn. At the former they are so destitute of oily matter as to be of little value, so that the taking them is chiefly for the supply of bait for taking other fish,—and nothing is so successful for this purpose. But when they appear towards the end of July, and until the season of spawning after the equinox, their condition is very different, and none of this family can by many degrees be taken in comparison with them. It is commonly believed that at this time their food consists of the seeds or early growth of sea vegetables, in supposed search of which they have been seen in large numbers quietly searching at the bottom in a small depth of water. On examining the stomach it is not usual to find anything besides a pulpy mass of what may be vegetable substance; but animal forms have also been discovered, and on one occasion, in the middle of summer, when multitudes were caught in drift-nets, as they were seen actively engaged in some pursuit close to the surface, an examination laid open the existence of vast numbers of a small shrimp-like creature, on which they had been feeding to repletion. On another occasion the stomachs of several were found to contain examples of the mackarel midge; and I have been informed that instances have been met with in which a Pilchard has taken the fisherman's hook. The rarity of such an occurrence may perhaps be explained by supposing that the size of the hook or bait, rather than want of appetite in the fish, is a hindrance to its being more frequent.

The roe of some kinds of fish may also be the occasional food of the Pilchard; as I have been informed by a gentleman who resided several years at Croisic, in France, that it is the custom with French fishermen to scatter the salted roe of fish about their (drift) nets, in order to attract the Pilchard into them, and that he had seen this spawn in the stomachs of the fish thus caught. I have learned also from the British consul at Brest that the use of the salted roe of fish is universal on that coast for the purpose of attracting the Pilchard into the nets; and hundreds of tons of the roe of the Cod and Ling are imported into that country for this purpose. It is scattered in the direction of the nets with a ladle, and the stomachs of the Pilchards are found to be filled with this food.

There cannot be a doubt that the fishery for Pilchards is of ancient date, and the regard in which the fish was held appears from its having been admitted into heraldry at a time when coats-of-arms were of great importance; but I find no mention of it in public documents before the age of Queen Elizabeth, when we find that the drying of Pilchards was among the monopolies granted by authority to some courtiers, the clamour against which so moved public indignation as to cause their surrender. But from this time the fishery is known to have so far attracted the attention of the public as to become the subject of particular laws, the special enactments of which afford proof that the methods of conducting it were different in some considerable degree from those practised at present, as well as the manner of preparing the fish for a foreign market. The use of seans is probably of great antiquity, and is spoken of by Carew as well known at the conclusion of the seventeenth century; and from the MS. accounts of the merchant Treville, at that date it appears that the fish exported to France and Italy was obtained chiefly if not solely by using them. But there is reason to believe that under the name of sean a different sort of net was employed from that which now bears the name. Thus, in a map contained in Norden's work, "Speculi Britanniæ Pars," A. D. 1728, two ground seans are represented in operation, one enclosing the other, and with one end of the outer sean held by a man who stands on the land, while the landward end of the enclosed sean is held by one who is a short way in the water. The further end of each net was termed the pole end, from a pole which kept it upright or spread out; but this is no longer used, although the name is still continued for the sean of much larger size and otherwise formed now in use. These distant ends are shewn in the plate as drawn along by two boats, one a little in advance of the other, and each of them managed by a couple of men; while two other boats are within the curve formed by the seans, as if directing the proceeding, and perhaps keeping back the fish, that they might not escape by the only opening, until the whole is safely drawn to the land.

The importance of employing two concentric seans will be seen when we know that the meshes were wide enough to allow the escape of large numbers of the fish; and it was not until the year 1605 (at the beginning of the reign of James the First) that a mesh was rendered legal, termed the Dungarvon Mesh, which should be sufficiently small to retain all the fish, and yet prevent any of them from becoming entangled in the mesh; which latter circumstance, if it were to happen, would be destructive of the whole adventure.

In the former mode of fishing here referred to, it appears that the fish were drawn on shore at the nearest beach, which must often be on the land on which neither the fishermen nor the purchasers of the fish had a right to intrude, and much quarreling was likely to be the result; to obviate which, in the year previous to the date above given an act was passed which made it lawful for Balkers, Condors, Huers, and other fishermen, in pursuance of their calling, to go upon high hills and grounds without being guilty of trespass; and it also permits other persons to attend the seans or nets for the purpose of landing or carrying away the fish thus caught. Persons, however, who came thither out of mere curiosity were subject to a penalty for their intrusion.

There still remain many local appearances which shew that the fish thus caught were not always carried away, but were salted and prepared for exportation at the places where they had been brought to land; but there is also evidence to shew that the quantity thus caught could not in any individual instance have been large, while the fishermen must have been often tantalized at observing the large abundance of schools which obstinately maintained a position at a somewhat greater distance than in their method of proceeding they were able to reach.

It is within the extent of our information, derived from aged fishermen, and reaching back to more than a hundred years, that some considerable changes have taken place in the times at which the larger bodies of these fish have come to our coast, and which appear more unaccountable than the merely capricious movements pursued in ordinary seasons, but which must have considerably influenced the methods pursued in the fishery, and especially on its success. Thus for upwards of thirty years at the middle of the last century, the most successful portion of the fishery was carried on after the autumnal equinox, and consequently by drift nets, since the seans could scarcely be then exposed to the risk inevitable from the stormy weather, and the long and dark nights. But towards the end of the same century a change took place, and the principal success was from the beginning of August to the end of September, when a large increase took place in the number of seans, and a profitable fishery was experienced by all of them. It is now again found that after a nearly equal extent of time, the winter fishery along the southward coast is alone or chiefly successful, and a diminution in the number of seans is the necessary result. There are not at this time more than a fourth part so many as were in use fifty years ago; and it is certain that it was not the withdrawal of the bounty alone that caused the lessening of the number.

But when in the summer the fishery is about to begin, it sometimes happens that immense multitudes of fish will collect far from land, with an evident intention to proceed towards the shallower water. An instance of this was met with in the month of July, at forty leagues in a south-west direction from the Scilly Islands; and so large and dense was the assemblage that the course of the ship was supposed to have been obstructed by them, and some were taken up by merely dipping a bucket among them. More usually, however, they do not assemble in large bodies until they have been for a time in the neighbourhood of the coast, and it is then that they assume the arrangement of a mighty army, with its wings stretched out parallel to the land; while the numberless smaller bodies of which it is composed are continually shifting their position, joining together and separating again. There are three stations occupied by this body which have great influence on the success of the fishery; one of which is eastward of the Lizard Point, and reaches to the Bay of Bigbury, near the Bolthead, in Devonshire, beyond which little success attends the fishery, although at Dartmouth some efforts are made towards it. A second station is from the Lizard to the Land's End; and the third is on the north coast, where the principal station is at St. Ives. It is common for one of these districts to be full of fish while few are to be seen in either of the others; but late in the season the schools often change from one district to another, or pass in succession along all the shores of a county. It is at this late season especially that they shew themselves at St. Ives, where, therefore, they are not usually expected until October or November; but when they come it is in immense multitudes, and usually from the eastward; a circumstance which is accounted for by the supposition that from the west they have been influenced by the course of a current that has taken a circuit of the coast bounded by the shores of Ireland, Wales, and the north of Devonshire.

In the ordinary season of the fishery the subordinate movements of the smaller bodies are much influenced by the tide, directly against the current of which they do not proceed; and the large extended body will sometimes remain at a distance from the land, although parallel with it, for several weeks, and then suddenly, as if by general consent, approach close to the shore, perhaps without the movement having been noticed until the fish have reached it. It is at this juncture that the principal opportunity is afforded for the successful prosecution of the fishery with seans.

One method of conducting the fishery for Pilchards is by drift or driving nets, the outfit of which consists of a number of nets, which varies according to the means of the fisherman, and in consequence of the size of his boat; but a usual equipment may amount to twenty, of which each net measures in length from eighteen to twenty fathoms: so that what is termed a string of nets may reach three quarters of a mile. These nets are fastened to each other in length, and to a head line, along which is placed a row of corks; and another line runs loosely along the middle of the nets to afford additional strength in rough weather, or when the nets are drawn loaded with fish. These drift nets have hitherto been made of hemp, of which the finer the quality the better; but within a few years a preference has been given to cotton nets, which do indeed become worn out in much less time, but yet are believed, coupled with their lower cost, to produce a greater profit by taking a far greater abundance of fish.

A set of these nets is carried on board the boat, which, on other occasions, is employed in the hook or other usual method of taking fish; but an addition is commonly required to the ordinary amount of the crew; for in turbulent weather, with a favourable capture, it requires no small degree of strength, as well as length of time, to lift the dripping burden from the rolling waves over the gunwale. The nets are cast or *shot* at about the going down of the sun, for the fish will not enter the meshes in broad daylight, and they are drawn on board, or *hauled*, in two or three hours. It is usual also to shoot them again as morning approaches, as the dusk of twilight is found to afford the best prospect of success, rather than deep darkness, which may be explained by the fact that the brilliancy of the briming is at that time less conspicuous. The nature of this appearance will be explained when we are describing the fishery with seans; but in a dark night, under its influence every thread of the nets appears as if on fire, and thus is rendered a terrifying object to a timid fish. A rope from the end of the string of nets is fastened to the bow of the boat, to be shifted to the quarter when the nets are *hauled;* and the whole thus stretched out is left to float with or across the tide without the sails being set, except in very calm weather, when a little headway is necessary, in order to keep the nets from becoming folded together. Within a few years an improvement has been made in the arrangement of the nets, by which they have been rendered more effective, and also those hazards avoided to which they had been exposed by becoming entangled in the keels and rudders of ships. It consists in diminishing the number and size of the corks along the head line, and in placing cords of the length of two or three fathoms at proper distances, with a stout buov of cork attached to each. By this means the nets are sunk beyond the reach of ships, and to a depth sufficient to reach the fish as they swim below, even when none are otherwise to be discovered. This method of reaching the fish, at whatever depth they swim, has long been in use on the coast of Norway in the taking of Herrings.

The other mode of conducting the fishery for Pilchards is by seans, for the fitting out of which two principal boats are provided, each of which is about forty feet in length and ten feet wide at the beam. The first of these is termed the sean boat, and is furnished with a sean that is about two hundred and twenty fathoms in length and twelve in depth; but these proportions are varied in different districts; and the whole is buoyed up along the head-rope with corks, and weighed down at the bottom with leads. The second boat is the volyer or follower, which carries a sean of from a hundred to a hundred and twenty fathoms in length, and eighteen at its greatest depth. In form, as well as in extent, this, which is termed the tuck sean, is different from the former, or stop sean, its middle portion being shaped into a hollow, or *bunt,* as best fitted to the use for which it is designed. A third boat, much smaller than the others, is called the lurker. The crew of a sean consists of eighteen men, with commonly a boy, and of these seven are assigned to each of the larger boats, while the remaining four, including the master seaner, belong to the lurker. On some parts of the coast another individual of no small importance is termed the huer, and on his skill in discovering the presence of the school, and the direction in which they are proceeding, in a great measure depends the success of the adventure. It is his duty to place himself in some commanding situation, and by well-known motions to direct the proceedings of the men afloat; and in the west of Cornwall, especially on the north, the fishery could not be conducted without him.

While the fishery lasts the master has the entire command of the adventure; and beginning usually about the 1st. of August, the boats proceed to some well-known sandy bay, and cast anchor, keeping a good look-out for the appearance of the school. This is expected to appear at the decline of the day, and is discovered either by the rippling of the surface, the leaping above it or *stoiting* of the fish, or by the colour of the water; which latter, where the sandy bottom is bright, becomes well marked. The master first proceeds in the lurker to the place where these appearances shew themselves, in order that he be certain of the magnitude of the school, with the direction it is taking, coupled with the state of the tide, and the freedom of the bottom from rocks.

The fish are alarmed at noise; and the firing of a heavy gun at the distance of twenty miles has been known to cause the fish to sink, and thus disappoint the labour of the fishermen. All the proceedings are therefore directed by signs, and when the circumstances are thus known to be favourable, a warp from the end of the stop sean is handed to the crew of the volger, whose duty it is to keep it *taut*, while the lurker preserves its station near the fish, to observe their motions, and point out to the sean boat the space to be enclosed. The sean boat at this important period is rowed by four men only, the other three being employed in throwing out or *shooting* the net; and so active is the strength exerted on this occasion, that this large quantity of net, rope, cork, and lead is thrown into the sea in less than five minutes. The sean thus thrown overboard at first forms a curved line across the course of the school; and while the larger boats are engaged in warping the ends together, to enclose the fish as in a pond, the lurker takes its station at the opening in order that by dashing the water with the oars the fish may be kept back from the only place where their escape is at this time possible. When the ends of the sean are thus brought together, and fastened with cords, if at the same time the quantity of fish is great, and the sea is rough or the tide strong, it is further rendered secure by heavy grapnels, which are carried off from it in the direction from which the danger is to be feared.

Such is the manner in which the sean is employed in first securing the fish in many places; but it varies in different stations, and more especially in the west and north of Cornwall. In these latter districts the generally light colour of the bottom enables the huer on the hills to discern the situation and motions of the school much more clearly than is the case on the eastmost borders, and on this account his services are the more highly important; and on the north coast, in addition to the usual sean, there is another net of about half the length of the former, which is called a stop-net, and is carried by another boat; and which, when the seaners begin to shoot what may be termed the principal sean, the second boat also throws out in the opposite direction. In some cases two of these secondary nets are employed, and even three, by which means the circle is completed in much less time and in a larger compass than if only one net were employed; and when the body of fish is large, as it often is at St. Ives, where this method of employing seans is chiefly practised, it is only thus that they could be effectually secured. It is also only under very favourable circumstances, and with considerable risk, that the fish thus enclosed in the circle of the net can be warped, as they sometimes are, from the situation in which they were first found into shallower water; but from this account of the proceedings of the fishermen it will be seen that it is not more difficult to take a thousand hogsheads than a much less number; the only difference being, that with the larger body the sean is regularly moored, while with a small quantity this is unnecessary. It may even be said that the taking of the larger body is the most easily effected; for as its movements are more slow, its course is less liable to be changed through any alarm.

When the evening is closing in, and in preference when the tide is low, preparations are made to take up the fish; and for this purpose the principal sean is left undisturbed, while the volyer passes within the enclosure and lays its sean, termed the

Tuck, round the former on the inner side; and then the latter is drawn together so as gradually to contract the space and raise the fish to the surface. When disturbed they become exceedingly agitated, and so great is the force derived from their numbers and terror, that the utmost caution is necessary to prevent their bursting the net or sinking it; while to hinder their return back again from the tuck sean into the larger space of the stop-net, men are employed at the open place in plunging stones which are suspended from ropes, and drawing them back again. It will be understood, from what indeed we have already remarked, that in these proceedings none of the fish can become entangled in the meshes of these seans; and the small size of the meshes thus rendered necessary to the success of this fishery was made legal for taking Herrings, Pilchards, Sprats, and "Lavidnian," by an act of the third year of James the First, (ch. 12.)

When the fish thus enclosed in the bunt of the tuck-sean have been brought to the surface, where they are almost dry, the seaners proceed to fix themselves in pairs across the gunwales of the boats, and with flaskets to lade the fish on board; while what is contained in the stop-sean, and has not been gathered into the tuck, is left to a future opportunity. It is one principal mark of a good master seaner that he forms a correct opinion of the quantity enclosed within the stop-sean, and that he is able to take from it with the tuck-sean only just so much as his boats can receive, and that can be properly disposed of in the cellar for that day. And in this his judgment is much assisted by the extent which he perceives of the briming; which is the term bestowed on the light which proceeds from numerous minute animals, chiefly molluscous, that abound throughout the sea at this time, and have become excited to produce it by the fear arising from the actions of the terrified fishes. In a dark night every mesh of a sean can be distinguished to a great depth by the effulgence proceeding from these creatures.

Many are the advantages which arise from this practice of taking up only a portion of the fish at separate times; for the whole can be salted in a proper condition without undue fatigue or expense, or injury to the fish by incipient putrefaction. The sean also is preserved from being broken, and the principal body of fish from being killed by strangulation or their own struggling weight: in which case the whole would be lost together with the sean, since no human force would be able to raise to the surface a thousand hogsheads of Pilchards after they were dead.

The work of curing the fish is performed by women; by whom they are piled up in careful order against the walls of the cellar: a layer of fish alternately with a layer of salt; and in this state they remain for thirty days, during which the oil and brine are suffered to drain from them into pits prepared for the purpose. The fish are then taken out and sifted, by which means the dry salt is separated from them; after which they are carefully washed, and placed in regular order in casks, each of which measures fifty gallons, and the staves of which are placed together with crevices, so that the oil with which they abound may on pressure readily escape. As these casks stand upright, a stout circular board is laid on the open end, and on this pressure is made by means of levers, to which heavy weights are attached; and the fish being thus repeatedly pressed down and the casks refilled for the space of nine days, and until the weight of the barrel is four hundred and seventy-six pounds, they are finally closed up and marked for exportation. It may here be noticed that the excellent naturalist Ray committed a singular mistake in the account he has given of the manner in which Pilchards were cured; but which may be accounted for and excused by the consideration that at the time of his visit to St. Ives, which was on the 1st. of July, he could not have seen the work in operation. He represents the pressing of Pilchards as effected by laying boards along the surface of "the bulk," (as "he conceives,") and "so press the fish equally." His informant appears to have thought the employment of a barrel so much a matter of course as not to require to be noticed, and the naturalist omitted to inquire.

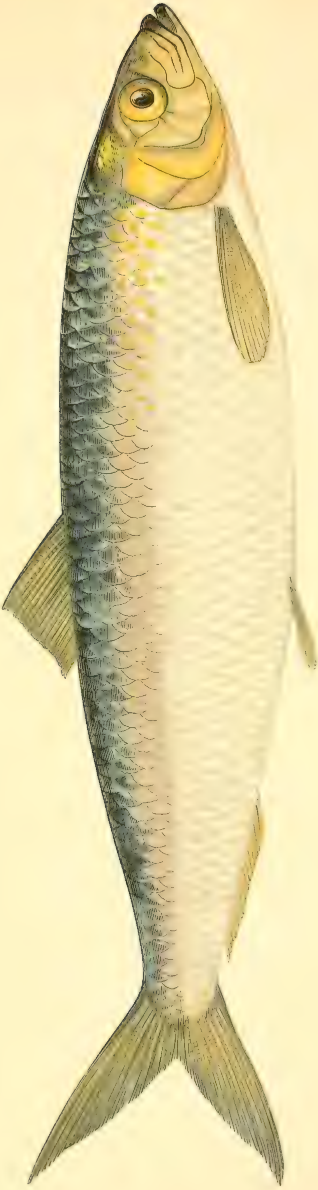
When the fish thus pressed are in the best condition eight or nine gallons of oil have been obtained from a hogshead; and so large a quantity is to be explained by the fact that not only are the entrails coated with fat, but the muscular structure of the body also; in which circumstance this fish differs greatly from the Herring, the oil of which is only obtained from the entrails; but the quantity of oil from the Pilchard diminishes very greatly after the month of September. The oil obtained from the Pilchard has been found to contain a larger amount of greasy matter than that from any other kind of fish; and is of much value in some sorts of mechanical employments. This practice of obtaining the oil by means of simple pressure is referred to by the county historian Carew, as being in his day a comparatively modern invention; and the common belief is that at a remote date the fish intended for exportation were preserved by being smoked; of which the name of fumado, by which they are now known, is a proof, for this word is only applied to Pilchards that are sent to a foreign market. The fish prepared for use at home are deprived of their heads and entrails, and thus kept in salt or brine; in which condition they form the winter stock of almost every family in the middle and lower condition of life.

In a long series of years the average quantity of fumadoes sent abroad yearly may be thirty thousand hogsheads; but on some rare occasions it has much exceeded this, and has amounted to sixty thousand; but on the other hand, in the years 1821 and 1822, the quantity respectively was little above two thousand and five thousand hogsheads. It is the drift-net fishery which for the most part supplies the consumers of Pilchards in our own country; and the amount caught by them may perhaps be equal to what is taken in seans. In the latter the largest amount caught at one time has amounted to three thousand five hundred hogsheads; which was at St. Ives in the month of November; but at the same place ten thousand hogsheads have been enclosed in the seans in one day, although not immediately brought to land. As an hogshead contains from two thousand five hundred of these fishes, to perhaps three thousand, it thus happens that the enormous multitude of thirty millions of living creatures have been secured at once from the ocean for human sustenance. From thirty to forty thousand is regarded as a favourable capture by drift-nets, of not very frequent occurrence; but the more frequent capture of a smaller number affords a sufficient remuneration to the fishermen.

This lengthened notice of a popular and important fishery might have been still more extended; but for other particulars we refer to several communications that are to be found in the Reports of the Royal Cornwall Polytechnic Society, and the

Papers by Mr. Richard Quiller Couch, in the "Zoologist" for 1847.

The ordinary size of a Pilchard is about ten inches in length, with a depth of one inch and three fourths; but it has been seen of the length of fourteen inches; plump and moderately compressed, with the body covered with scales that are easily lost. The head a little flattened on the top, nostrils nearer the snout, under jaw a very little the longest, no perceptible teeth; a broad circularly-formed mystache, which passes back to the front of the eye, which organ is moderately large. The gill-covers are formed of numerous plates, the hindmost with diverging rays passing downward. Along the belly a firm ridge or series of peculiarly-formed scales; and those at the union of the head and body are obscurely striated; the others simple. The single dorsal fin is placed at the centre of gravity of the fish, with eighteen rays; anal fin narrow and far behind; pectoral near the termination of the hindmost gill-cover, and not reaching opposite the first rays of the dorsal; the rays sixteen; ventral fins with short wings, and eight branched rays; the tail deeply divided; with twenty-two perfect rays. Colour of the back greyish blue, more blue or green in the younger examples; the belly white; sometimes pink tints on the sides; a golden spot sometimes on the upper part of the gill-cover. Sometimes for a whole season they are found with a row of spots on the sides, as in the Scadina, *(Alosa Finta,)* as is remarked by Willoughby; but these spots appear as if caused by disease, the fish thus marked being less than the usual size, soft in texture, and unfit for being cured. Our supposed Sardine is also commonly thus marked. Individuals have been seen having no dorsal fin, and also with the tail of twice the usual size.



HERRING.

Harengus,	JONSTON; Pl. i, f. 6.
"	WILLOUGHBY; p. 219, Table P. 1.
Clupea Harengus,	LINNÆUS. CUVIER. BLOCH; Pl. 29.
" "	FLEMING; Br. Animals, p. 182.
" "	JENYNS; Manual, p. 435.
" "	YARRELL; Br. Fishes, vol. ii, p. 183.

IN habits as well as in shape the Herring bears much resemblance to the Pilchard, but its range is extended further to the north; so that it has been seen at rare intervals even in Iceland; although the Missionary Egedè, who was familiar with that country, had not met with it there. They also abound on some occasions along the east border of North America, up to the coast of Behring Strait, and were found by Sir John Franklin in Bathurst's Inlet; while they exist, perhaps in large numbers, on the west coast of the same continent, and again on the east side, in Delaware Bay, where a fisherman informed me he had been engaged in securing great quantities which were attracted to the boat by a light; and so numerous were the multitudes thus drawn together, that it was not found necessary to employ any other means of taking them than what is termed a hand or keep-net with which to lade them on board.

It has been questioned whether this fish exists in the Mediterranean, and it appears that no direct mention of it can be traced to the ancient Greek and Roman writers; but their silence on this subject is of little value, from the small degree of discrimination they shew in reference to fishes which bear a near resemblance to each other; and we further know that there are some species scarcely rare in that sea, of which they have not left us any notice. Dr. Gulia has not met with it at Malta, but Mr. Dodd, in his Natural History of the Herring, informs us that he himself had caught some examples near the coast of Algiers, and the Russo-German naturalist Pallas assures us that they abound, sometimes in large schools, in the Black Sea and Sea of Azoff, as also in the Caspian. It is worthy of record also that at an early portion of the present century some fishermen of Cornwall were employed by the Russian authorities in teaching the fishermen of the Russian coasts of the Black Sea the manner of ordering nets in drift fishing; in doing which among a large number of Herrings was found one solitary Pilchard; which circumstance however at least proves the existence of the latter in the Black Sea. It should be remarked further that the Herrings of the Black Sea are said to differ from those of our own shores in the proportions of the head, and in the teeth, which on closer examination may mark a separate species.

But although common, and at times abundant, on the west coasts of England and Ireland, it is in by far the largest numbers in those parts of the British Islands and the north of Europe, where the Pilchard is rarely or never seen. Thus it is known in the White Sea of Russia, and down the coasts of Norway and Denmark; and on the opposite shores of the United Kingdom a fishery for Herrings has been followed beyond record with eagerness and success; while at the present time it forms, both as regards the quantities taken and their quality as food, as important a fishery as any in our own kingdom, or in Europe; as also it must be allowed that from the capricious motions of the fish it is to be classed among the most precarious. For many of the particulars of this uncertainty we are indebted to the copious treatise on the History of the Herring, by Mr. John M. Mitchell; but the influences which lead to the local changes in its places of resort, and the variations of the season, with the differences in the goodness of its flesh and of the size of individual schools, appear to be matters beyond the powers of human scrutiny to explain. That the difference of season in which the Herring resorts to different portions of our own coasts, is not immediately under the influence of latitude or climate is certain, since in many cases it is earliest in the further north, and in others the reverse; but on the whole there is the observed regularity, that the spawn is shed twice in the year, of which that of the autumn is the most conspicuous; but the season of either of these is often extended or delayed beyond what may be considered the more regular time; from which cause it happens that in the opinion of fishermen they may even be said to be in spawn throughout the whole of the year; and it is often in the end of December they are engaged in this office of nature. There cannot be a doubt that many of the subordinate actions of this fish are regulated by this innate propensity of nature; and it has been well remarked by those who have had the wisdom to discern the hand of the Author of Providence in His works, how great is the blessing thus bestowed on man, in supplying him with abundant and excellent food at the time when it is best fitted to his use. Nor is it an objection to this that the movements of these fishes while with us are apparently uncertain, and that they do not remain in any district for more than a few days. In men the virtues of vigilance, patience, and skill are thereby called into exercise, as the same are demanded indeed in some degree in every other pursuit which men must follow for their daily bread.

We are informed that at Stornaway, in the Scotch Isle of Lewis, the Herring fishery begins on the 20th. of May, and the law forbids its earlier commencement; but the 1st. day of June is thought sufficiently early in the north of Scotland, whilst off Shetland they are first fished for at the beginning of July, and other large schools do not shew themselves before November and December. On the east coast of Scotland they chiefly abound from September to October, but are taken onward from November to January; and Dr. Parnell remarks that they will remain for two or three weeks at the mouth of the Firth of Forth before they ascend; but they abound on the coasts of Dunbar and Berwick in June, July, and August, when scarcely a single Herring is to be seen higher in the Forth. In the west of England they are caught in the most abundance from about the end of September to November, but sometimes, as in the years 1863 and 1864, they are also in good quantity through January and February; and there are years when large numbers of the best quality are caught in July and August; but it seems certain that in the generality of these instances the schools which thus shew themselves are either of different age, the progeny of different parents, or under different circumstances of spawning. We cannot venture to draw any conclusion from such variations with regard to the extent of their wanderings when they have disappeared from our view. The only probable conjecture regarding it is that in their ordinary habits they only pass from the deeper water to the shore, to return to the former again immediately as the great duty of spawning is accomplished. On the whole, the general constancy of this fish to the British coast appears not the less worthy of notice, since we are informed that as regards Sweden and a portion of Denmark, they have long ceased to appear in districts where once they were known and welcomed; and although, if we could look back to a much greater distance of time, the visits may have been more unusual than the departure, yet in this respect also this alternation of habits bears a resemblance to what we have already noticed in the Pilchard. Thus we are told that in Loch Roag, in the Island of Lewis, the scarcity or absence of the Herring and its abundance have taken turns at intervals of from thirty to forty years; and at Cromarty, says Mr. Mitchell, a very extensive fishery was carried on from 1690 to 1709, and in 1707 an immense shoal was thrown (or rather ran themselves) on shore in a little bay to the east of the town, so that the beach was covered with them to the depth of several feet; but, strange to say, they left the Firth in a single night, and no shoals again made their appearance for more than half a century.

We have already said that without doubt a principal impulse which drives the Herring to our shores is the instinct of shedding its spawn; and it seems certain also that such individuals of these fishes as are in an equal degree of forwardness in the preparation for this function, are collected into one company; in proof of which it was observed, that early in January, 1864, not far from Plymouth, all that were caught in drift-nets on one day, to a large amount would be *shotten*, while an equal number on the day before or after would be full of roe; and the fishermen had good reason to notice this, as the price of each capture differed considerably. I am informed that no Pilchards are found to be mingled with these assembled bodies of Herrings, although it is common to find Herrings among a collected body of Pilchards.

In these schools there are many more males than females; and how prolific they are is shewn by the incalculable numbers that are taken from the sea by human industry, which in Scotland alone amounts annually, on an average, to about five hundred thousand barrels prepared for exportation, besides a large consumption at home; and this must form only a moderate proportion of what is taken in other parts of our own country. It is probable, further, that the multitudes which in every stage of their existence fall a prey to the ravenous inhabitants of the ocean are still more considerable: for when only just escaping from the egg they are watched for and devoured by the many small fishes which have, only a little before, themselves been exposed to the same fate. When of larger growth they are the food of fishes near the shore; while later in life they are the victims of Dogfishes and Sharks, Blowers or Physeter Whales; and fishermen are guided where to shoot their nets by gannets, which sail aloft in the air, and with piercing sight discern their prey at no small distance beneath the wave. With instinctive judgment the bird rises to a height that in its fall shall carry it to a sufficient depth, and then with half-closed wings it drops with headlong plunge upon its prey, and rarely returns to the surface without the prize.

But in addition to these causes of destruction, which may be regarded as unavoidable, there are others which are caused by ignorant human agency, and which, therefore, are so much more to be deprecated. We are informed that on one occasion, near the end of August, when the fishermen of Dunbar had discovered that a school of Herrings were in the act of spawning near the land, they let down their nets close to the ground, by which large numbers were taken, and when drawn into the boat the spawn was found to flow from them in great abundance; and yet after this the fishermen continued the same thoughtless conduct. And the evil result of such unseasonable waste has been shewn in another instance on the coast of Norfolk, where an enormous quantity of the fry was caught in the spring in those bags of net called stow-nets; and for three years afterwards the numbers of Herrings in the autumn in that neighbourhood were so small that fishermen scarcely thought it worth their while to employ their time in fishing for them. If we could suppose, that, like many migrating birds, and the Salmon in the sea, Herrings were led instinctively to return from the deep water to the place of their birth, much of the obscurity which (as we have seen) hangs over their motions would be removed.

It has been confidently believed that the spawn is shed near the surface, and not far from land, although where the water is deep, close to the rocks, there is reason to think that it may take place at the distance of a few miles; but it is Mr. Mitchell's opinion, supported by his own observation and that of a Russian observer, that this function takes place close to the bottom on hard or rocky ground. To the foregoing account, therefore, we add:—"We have fully ascertained that the shoals generally fix in one locality for depositation, and that immediately after spawning the Herrings proceed to sea. The proper incubation is as follows:—The female remains quiescent at the bottom. The whole of the roe is at once deposited. The milt, thoroughly ripened in the male, has become changed from a solid mass to a liquid of the colour and consistency of cream: the roe, although placed in the briny flood, becomes a firm united mass, somewhat larger than, but similar in shape to the roe in a full Herring. This lifeless mass, or egg-bed, has the power of adhesion: it grasps the stones, the rocks, the sea-weed, etc., so firmly that we have found it difficult to remove or separate it until the mass was dried or dead. In fourteen days, or perhaps three weeks, the young are seen in great abundance near the shore, of a very small size; in six or seven weeks more they are observed to be about three inches in length, and it is likely that they attain to full size and maturity in about eighteen months." In the early stage of growth they keep together, and so close to the shore that many of them are left in pools by the ebbing of the tide,—a circumstance we have not noticed as happening to the Pilchard; their movements, also, are as if actuated by a common impulse. But all the circumstances we have mentioned have a tendency to lessen their numbers, so that we may well wonder how it is that the race itself is not extinguished.

Lacepede says that in North America the spawn of the Herring have been carried by the inhabitants and deposited at the mouth of a river which had never been frequented by that fish, and to which place the individual fishes from these spawn acquired a habitude, and returned each year, bringing with them probably a great many other individuals of the same species: a circumstance which seems to countenance the supposition we have already made, and might be followed elsewhere with advantage.

The appetite of the Herring is ready to exercise itself on a large variety of food; but it may be questioned whether in this, as in other instances, its eagerness or indifference as regards particular sorts may not be influenced by the state of the constitution in the quiescence or development of the milt and roe. It seems certain that it feeds on entomostraca and the younger or smaller crustaceans, which people the waters in numbers beyond calculation; but it also devours creatures of a larger size, since young fishes of several sorts, with the smaller Launces of the length of a couple of inches, have been found in their stomachs, and even the grains of roe and young examples of their own species.

That considerable numbers are taken with a rod and line all round our coasts is well known; but although the Herring is said to leap sometimes above the surface after a fly, it is to be doubted whether what is made to imitate a fly on the hook is not regarded by it rather as some young fish; and it is even known to seize the bare hook if made of a white and shining material. Several hundreds of Herrings have been taken at one time in this manner, and a large number of hooks on one line let down into a school have brought up a fish on every hook; but it is said that this manner of fishing has only been successful when employed between sunrise and sunset. A singular instance has been related where there was found in the stomach of a Herring a copper farthing token, in size a little less than a shilling, and marked of the date 1757. As marks of distinction in their actions between the Herring and Pilchard fishermen inform me, that the former seldom springs from the water, or *stoits*, except when driven or alarmed; but the Pilchard does it often, and apparently through wantonness. When alarmed, as they are easily by noise, these fish will rush along to the distance of five or six feet, as marked by the briming; but the Pilchard does this more rapidly than the Herring. When alarmed the rush of the Mackarel is much further than either of these fishes.

There is proof that this fish was from the earliest times in estimation as food by the highest orders of society, as well as by the lowest; while in its salted or smoked condition it was among the principal of the stores which necessity compelled them to lay in for their winter stock of provisions; and the smoke of their dwellings, before the common use of chimneys, however irksome in other respects, afforded an important conveniency for the last-named process of preserving the fish. There were not only religious considerations that demanded the frequent use of fish as food, but it was also a variation from the diet of salted flesh, in times when the scarcity of fodder compelled even the richest persons to kill and salt their cattle at the approach of winter; at which season, from defective cultivation, they were only able to keep alive so many as would secure the stock for the succeeding year. As an instance of the ordinary use of the Herring in a noble family, we are told in the Northumberland Family Book, that there was appointed for the breakfast for the Earl and his Lady, besides other things, as a quart of beer and a quart of wine, two pieces of salt fish, six baconed Herrings, four White Herrings, or a dish of Sproits; these baconed Herrings, no doubt, being what we now know as smoked or red Herring. And in the time of Henry the Third, when the Princess Margaret was married to the Duke of Brabant, and the royal couple were about to sail to that country, among the other provisions furnished to the ships were ten thousand six hundred and fifty-two Herrings, with two hundred and ninety-two Cods and two barrels of Sturgeon. Again, in the year 1429, the Duke of Bedford sent five hundred carts loaded with Herrings to victual the army which was besieging Orleans and the neighbouring towns; and when the French attacked this convoy they were defeated.

In Ochlanschlœger's poem, "The Gods of the North," the following reward is offered by Skerner to the ferryman to carry him across a river:—

"If thou wilt ferry me o'er the wave,
I'll give thee oat-cakes and Herrings beside."

And this reward the ferryman regards as of high value—

> "Thou talk'st like a Lord of wealth and power."

The Herrings must have been carried with him as food, as he actually gives them on the spot to the giant ferryman.

In Blount's "History of Strange Tenures of Land," we are told that in the charter of the town of Yarmouth, which town has ever been famous for its share in the Herring fishery, the corporation are required to send a hundred Herrings, baked in twenty-four pasties, to the Sheriffs of Norwich, who were to deliver them to the Lord of the Manor of East Carlton. And at the same time Eustace de Carme and others, who probably were the same Sheriffs, are said to have held thirty acres of land by the service of carrying to the king, wherever he should happen to be in England, twenty-four pasties of fresh Herrings at their first coming in. But in still more ancient times they formed an important source of income; for Sir Henry Ellis informs us in his Introduction to Domesday Book, that Hugh de Montfort's manors in Suffolk yielded numerous rents of Herrings; and the manor of Beccles, in that county, in the time of King Edward the Confessor, yielded thirty thousand Herrings to the Abbey of Saint Edmond, and in the days of the first William this number was increased to sixty thousand. But the Abbey of Saint Edmondsbury was not so fortunate; since in the fourteenth year of Edward the First, the expenditure of the monks in the fast of Lent for Herrings was £25., when the yearly expenditure of the kitchen for food in general, including other fish, was £520., and a fat ox was purchased for four shillings.

That we may not further extend this reference to ancient customs, we come down to Tusser, who says—

> Let Lent, well kept, offend not thee,
> For March and April breeders be;
> Spend Herring first, save salt-fish last,
> For salt-fish is good when Lent is past.

The most usual manner of fishing for Herrings does not differ greatly from that already described, as employed in the open sea for Pilchards; but the meshes of these drift-nets are a little larger; the distance being allowed of an inch and a quarter from knot to knot, while those of the Pilchard-net are an inch. Great exactness in this respect, however, should not be demanded, since by the operation of barking the twine will contract to the extent of three meshes in a yard; and that of cotton more than in ordinary hemp; on which account when quite new a larger dimension must be required, which will permit many fishes to pass through, or less than the extent exacted by law as allowing for the contraction produced by use. According to the circumstances of weather, or the light of the night, these nets are sunk more or less deep; and for this purpose there are buoys placed along the head-line at regular intervals; and in Scotland especially these buoys are often made of inflated skins; and even strong globular glass bottles have been used, at least in the north of Europe; and occasionally small weights are placed on the lower border to keep them properly down. These nets are shot across the course of the tide, and consequently athwart the course which the fish are proceeding; and they are lifted on board by the aid of a capstan two or three times in the course of the night; for it is only in moderate darkness that these fish will enter a net, since at other time their sight is sufficiently good to discern the snare, and they are afraid to approach it.

The size of the boats employed in this fishery varies much in different places, and, consequently, the number of men in each; but it would be tedious to take notice of the practice of every station, and therefore we confine ourselves to that of Yarmouth, which is, and ever has been, the most important seat of this fishery in the United Kingdom. These boats are luggers, with three masts, and of a burden from twenty to fifty tons, with a crew of twelve men and a boy, whose wages are in proportion to the success they meet with; this being the only plan on which success in any fishery can be secured. The nets are about a hundred in number, and each of them eight fathoms in length, with a depth of five fathoms; and as when well loaded with fish no human efforts would be sufficient to lift the mass over the gunwale of the boat, a portion of the crew are employed at the capstan, while the rest are engaged in shaking out the fish into the proper compartment, and arranging the nets in order. As, from the general shallowness of the water near the land in the north of England,

and the belief that the largest Herrings are to be found at a distance from the coast, the fishery is often pursued at a considerable distance, from which, consequently, the return to shore cannot be speedy, it is the custom to sprinkle the newly-caught fish with salt, by which means also they are in the best condition for being smoked, for which process the largest fish are always preferred.

There is another mode of fishing for Herrings, which is conducted on a much less extensive scale, and which is founded on the knowledge that these fish often come near the shore, where, especially in rough weather, it would not be safe for a drift-boat to follow them. It consists in mooring a few nets without their being attached to a boat; but we believe that on several accounts this practice is not sanctioned by the law; as, we may venture to say also, however ancient, ought not to be those fixed erections or stations termed yairs and cruives, on the beach, within which the fish are kept enclosed when the tide has ebbed and left them dry.

It appears that a sean of some sort is employed on the coast of Ireland, but, as described, is much less skilfully contrived than the Pilchard sean of Cornwall; and if in general use it would interfere greatly with the success of the drift fishery, by contracting the space within which the latter could be employed. We believe also that not long since ingenuity has contrived to render the trawl effective in the fishery for Herrings, by using it somewhat on the principle of a moving stow-net. The gaping and enormous bag is sunk to the proper depth by a rope, and in this condition is carried along among the hosts of fish by the moving vessel. This method of fishing ought not to be practised within a limited distance from the older forms of fishing with drift-nets. In the great work of Duhamel on fisheries a lengthened account is given of the various ways of catching Herrings along the coasts of Europe, but none of them are superior to the methods practised in England.

Contrary to the custom of Cornwall as regards the Pilchard, where, except those which are sold to the public for family use, every master of a boat cures his own fish, in Scotland and the north of England the produce of the night is disposed of to professional fish-curers; and upwards of a hundred pounds in a week for a considerable time has thus been paid by one individual: a circumstance of no small importance to those adventurous fishermen who have come thither even from the extreme west of Cornwall to reap this harvest of the sea in the north.

It would require a very extended notice if we were to enter into a minute account of the proceedings of this fishery at its different stations in the United Kingdom, and the methods of preparing the fish for the home and foreign market; but we the rather forbear because the whole of what might be advanced is to be found in Dodd's "Essay towards a Natural History of the Herring," Brabazon on the "Fisheries of Ireland," and Mitchell's work already referred to; together with a paper by Dr. Mac Culloch in the "Journal of the Royal Institution" for 1824. This fishery has also been the subject of much (and not very wise) legislation; but we content ourselves with saying that at present it is with us in a condition of much prosperity, since from Scotland alone there is exported annually, on an average, five hundred thousand barrels, of which each one holds four hundred and eighty fish; and in Galway almost thirty thousand hogsheads have been cured in bulk in a single year: a remarkable contrast to the time when, as we glean from some ancient documents, a portion of those which were consumed in Britain were imported from foreign countries.

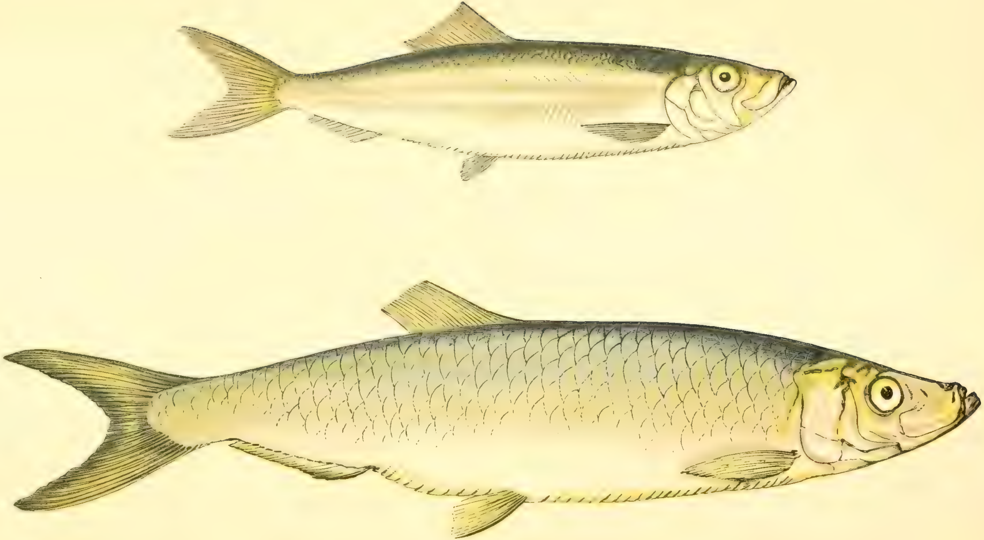
When we consider the never-ceasing war that is carried on against this race of fishes, it may be supposed that few of them can be so fortunate as to reach the full size of which they are capable. But there was an individual which chanced to obtain the length of about seventeen inches, while our more moderate sized example measured only twelve inches to the fork of the tail, with a depth of two inches and a half. The lower jaw protrudes beyond the upper: teeth minute, and a few in front of the palate; gape expansive; mystache broad, curved, reaching opposite the middle of the eye; the upper jaw, with the mystache, lifts upwards on a hinge. Nostrils nearer the snout; eye moderate, inclined to oval; head on the top less flat than in the Pilchard; gill-covers in several divisions, without diverging rays on the hindmost. Scales rather large, easily removed. Body less plump than in the Pilchard, and with much less fat between the muscular fibres; although something of this appears in the finer fish caught about July. The dorsal fin is behind the centre of gravity, with nineteen rays, the first very short. Pectorals placed close below the hindmost gill-cover, having fifteen rays; ventrals beneath the dorsal, having nine rays, with a free scale at its root, half its length; anal fin wider than in the Pilchard, with sixteen rays; tail forked. Colour of the back dark bluish, a tinge of pink often on the sides, silvery below; behind the top of the head tinted yellow; fins semi-transparent; along the belly a ridge, with scales not easily counted. The air-bladder is silvery, long, and slender; much more slender forward to the base of the skull, where it ends between two projecting processes, to which it is joined by two diverging sets of fleshy fibres; posteriorly it reaches close to the vent; and in its course it receives a lengthened and slender tube from the end of the stomach, the use of which seems uncertain. It is the same in the Pilchard.

LEACH'S HERRING.

Clupea Leachii, YARRELL; Br. Fishes, vol. ii, p. 193.

MR. YARRELL was of opinion that he had ascertained the existence of a species of Herring that was different from the common kind, and of which he gave the character, that "it was found heavy with roe at the end of January, which it does not deposit till the middle of February. Its length is not more than seven inches and a half, and its depth near two inches;" and in proof that the time of spawning and difference of the quality of its flesh are decisive marks of a difference of species, a quotation is produced from the Essay on the Herring, by Dr. Mac Culloch. In Mr. Yarrell's further description of this fish, besides dwelling on the greater comparative depth of the fish, he also mentions the dorsal fin as somewhat anterior to the place it occupies in the kindred species; and the number of vertebræ as being fifty-four, whereas in the Common Herring they amount to fifty-six.

But while placing much dependence on these particulars as marks of distinction, this eminent naturalist does not appear to have been aware of the fact, which has been noticed by numerous observers, that the exact magnitude, minuter proportions of shape, and quality of the flesh in the Common Herring are so very different, even in districts not very distant from each other, that none of them can be regarded as signifying a different species. The difference in the season of spawning, on which Mr. Yarrell appears to build so much, is even of less importance, since it will vary in different schools within very narrow limits; as we have already recorded in our History of the Common Herring; and the season of 1864 is not the only one in our notes, in which the immense body of fish, from at least the coast of Norfolk to Cornwall, has been large with spawn from the end of the preceding year to the beginning of March. The greatest depth of the body in examples of about the length mentioned is not of uncommon occurrence; so that while other portions of the description apply as closely to the Common Herring as to this supposed new species, the difference in the number of the vertebræ is all that remains for consideration; on which particular I feel much satisfaction in having obtained the assistance of Dr. John Lowe, of Lynn, in Norfolk; from whose communication I quote the following particulars:—Of nine specimens selected for examination, in two the vertebræ numbered fifty-four, in four the number was fifty-five, and in three fifty-six. I have myself counted fifty-two. The number of fin-rays also is liable to variation; and as regards the exact position of the dorsal fin in reference to the ventrals, it is also of a variable character; as in some when suspended by it the fish becomes almost vertical, but it also is known to vary with the age of the fish, and the proportion of the depth of examples to the length has varied almost in the same proportion. With these observations we are driven to the conclusion that Leach's Herring cannot on the evidence given be received as a separate species.



1. [illegible] 2. WHITEBAIT.

[illegible]

SPRAT.

Aphya phalerica,	Rondeletius.
Clupea sprattus,	Artedi. Linnæus.
" "	Yarrell; Br. Fishes, vol. ii, p. 197.
" "	Jenyns; Manual, p. 435.

Willoughby was so far misled concerning this fish as to regard it as the early condition of the Herring and Pilchard; but although Artedi definitely distinguished it from both these fishes, in this he was only so far followed by his friend Linnæus, that he makes the Herring to be a separate fish from the Sprat, without noticing the Pilchard as distinct from both. But after such evidence, with the opportunities of inquiry within his reach, it appears remarkable that Dr. Fleming continues the error of Willoughby, by still supposing the Sprat to be no other than the young of the above-named fishes. How little the true Sprat is known in the Mediterranean appears from Risso, who supposes it to be the same with the Sardine, which fish more closely resembles the Pilchard, although probably also distinct from it.

The Sprat is known in the German Ocean and the Baltic, and from thence round the British Islands, as along the coasts of France, as also in the west portion of the Mediterranean, as I learn from a private communication of Dr. Gulia, of Malta; and wherever it occurs it is a social fish like others of this genus. Dr. Parnell remarks that "they are found in the Firth of Forth through the whole year, and like many small animals appear very susceptible of cold. During the warm summer months they are seen sporting about in large shoals in every part of the Forth." But although at times abundant in the west of England, it is found there less frequently than on the more eastward coast of the kingdom. It also disappears there more completely than the before-named fishes in its season of absence, and is not looked for until a little after midsummer and towards autumn, after which it becomes abundant, and continues to be caught through the winter; but its time of appearing varies in different places and in different years, and the same uncertainty appears to exist in regard to the season of spawning, which, however, occurs in summer, and probably late in the autumn also. It appears, however, that the young fry are not so well known as those of the Herring and Pilchard; but in July and August they have appeared in multitudes of the length of two inches or a little above it, and are preyed on by many kinds of fishes, which pursue them in all directions along the surface, and before which they fly as a flock of sheep before dogs: but a mass of floating sea-weeds affords them a welcome refuge from their persecutors.

I have not heard of an instance where this fish has been caught with a hook, which may be because its mouth is too small for such as are usually employed at sea; for there is no reason to suppose that it is less ready to seize its prey than others of its race. But the usual manner of fishing for them is with an enormous bag-net, made with small meshes, which according to law must not be less than half an inch in measure from knot to knot; and this net, called a stow-net, is forbidden to be used at any time between the 10th. day of November and the 10th. of February; but ground-seans for Sprats are legal between the 1st. of November and the 1st. of April. The mouth of the stow-net is kept open against the course of the tide by a couple of beams, one above the other, at the height of about six fathoms; and they thus remain suspended from a boat in such a manner that as the fish are carried along with the tide they are driven into a gulf from which there is no return. A few of larger size and of the better quality are sometimes caught in drift-nets; and the quantity altogether thus taken is enormous,—thus affording a cheap and esteemed food in many places on the coast, and especially, although not solely, to the poorer classes of the British Metropolis, for they come to the table even of the rich.

But it is not always for food that the fishery is conducted for Sprats, for we believe they are not prepared for exportation;

and although some are preserved by smoking, in some measure as the Herring is prepared, and they are even imported from abroad in that condition. Yet the quantity taken sometimes very much exceeds the sale for any of these purposes; and it has therefore grown into a common practice to purchase them for manuring the land, and the nets have even been put to sea with no other view than thus employing the produce. Sprats are not usually sold by number or weight, but by measure. The nets are employed at from close to the land to the distance of about three miles, and the price varies from sixpence to eighteen-pence the bushel. Mr. Mitchell informs us that in December, 1861, in Scotland, when Sprats were abundant, they were sold at from two shillings and sixpence a bushel, at a time when the price of Herrings was five shillings the hundred.

A large Sprat may be five or six inches in length, but the more usual size is three or four inches; the body compressed, deeper than in the Herring and Pilchard, but tapering forward towards the head and mouth. Under jaw longest, both having very small teeth; mystache running back to the eye; top of the head flattened; eye rather large. Gill-covers as if divided into several pieces. Scales on the body easily lost. Along the belly a ridge with prominent serrations, the segments thirty-five to the vent, which structure will distinguish the Sprat from the young of the Herring and Pilchard, even by the sense of feeling: but other marks are—that the scales are more easily removed, the colour less bright, and with less reflections of tints when taken from the water. The dorsal fin also is nearer the tail, with eighteen rays, of which the first is short, and the two last united; the pectoral pointed, with eighteen rays; anal narrow; ventrals with eight rays, and not having a separate wing; tail forked, with eighteen rays. Colour light blue on the back, all besides silvery, except that sometimes on the sides it is yellowish; the fins tinted with yellow. The number of vertebræ forty-eight or forty-nine, which is less than is counted in the Pilchard or Herring. Cuvier says that the yellow on the sides occurs only in the season of spawning.

It is to be observed that the relative position of the dorsal fin of this fish is not always as pointed out by authors. Dr.

Parnell says the dorsal fin commences exactly half way between the point of the lower jaw and the end of the middle caudal rays, but Mr. Yarrell represents it as commencing half way between the point of that jaw and the end of the caudal rays; and I have found in a fish of the length of five inches and a half, that from the middle rays of the tail to the line of the first ray of the dorsal was three inches. The origin of the ventral fins is before that of the dorsal, and these first-named fins have in several instances the wing or separate scale, the absence of which therefore cannot be taken as a character. When not deprived of its scales the colour and tints are also sometimes beautiful.

SARDINE.

Clupea Sardina, Cuvier. Risso. Bloch; pl. 29, f. 2.

Cuvier says of this fish, it is so much like the Pilchard that the only perceptible difference is its inferior size: and a persuasion of their being only varieties of each other has prevailed widely, although, as Swainson observes, it is not easy to believe that fishes which differ so much in their range, and in some degree in habits, as the Pilchard and Sardine on the one hand, and the Herring and Baltic Membras on the other, can be respectively the same. I have supposed that in some instances they may have been confounded together, as Duhamel certainly has done; and Dr. Gulia has shewn that in the Mediterranean three separate species are known by the name of Sardina, one of which, the *Clupea auro-vittata* of Swainson, has probably been taken in England. But the following record in my notes is deserving of attention, as leading to further inquiry, both as regards the distinction of species, and the occurrence of the Sardine in Britain.—In the year 1843, six hogsheads of (Pilchards) taken, the fish about six inches long, and multitudes are so small as to pass through the meshes of the drift-nets. They are marked with spots along the sides, which grow faint and disappear as the colours fade. Compared with a Pilchard of the same size I find the marking of the head different; the plate encircling the eye on its lower part and under being much narrower, and guttered on the lower margin, where the Pilchard is plain. These small fish now abound at all distances from land, and in consequence all the fish in fine condition that were found a week or two before have disappeared.

The Sardine is common on the south coasts of France and Spain, and through the Mediterranean, where it forms the subject of extensive fisheries. They are also imported from thence into Britain; having been deprived of the head, boiled in oil, and inclosed in small tin boxes, which are carefully soldered to exclude the air; and it is worthy of notice, as forming an opposite character from that of the Pilchard, that the Sardine is in its best condition in the spring, and not in the autumn. The Sardine appears to be the only fish of this family, except the Pilchard, that has the dorsal fin at the centre of gravity.

Captain Cook found it at Nootka Sound, on the west coast of North America, where the natives preserve it by smoking; and I have been informed by sailors that they have obtained what they supposed Pilchards, as also their enemy the Hake, further to the south along the same coast.

WHITEBAIT.

Clupea alba,	Yarrell; Br. Fishes, vol. ii, p. 202.
“ “	Jenyns; Manual, p. 436.
“ *latulus,*	Cuvier.

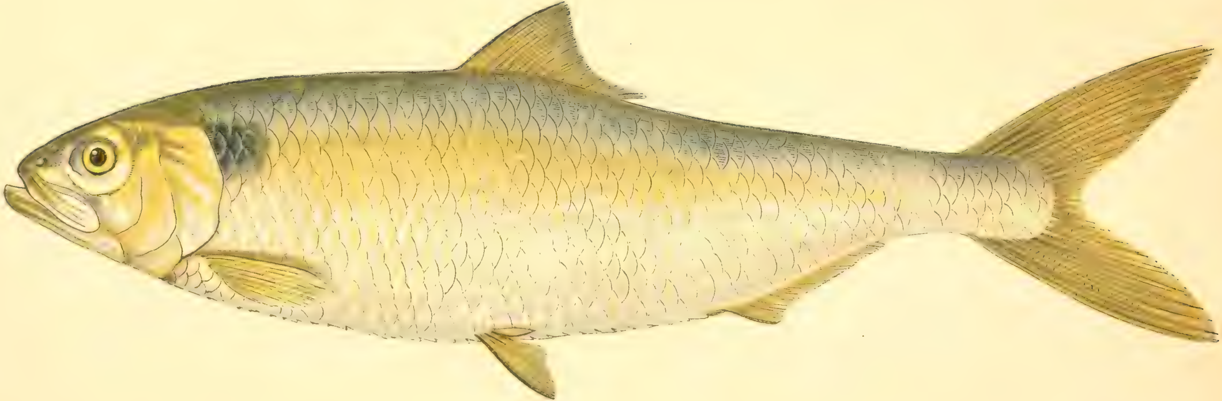
The notice of the public was first directed to this little fish as forming a delicious article of food; but it remained for Mr. Yarrell to decide that it is a distinct species, and not, as had been supposed, the young of some one of the well-known species of the Herring family, and particularly of the Allis Shad. It was also believed that it did not exist elsewhere than in the Thames, where a fishery was carried on to supply an extensive demand from the people of London; who had rendered it fashionable to go in parties to the taverns on the banks of the river to feed on this luxury, with, it must be added, such other accompaniments as might render the treat a rather expensive one. What had begun among the more obscure classes of the Metropolis, in the course of time extended to those of the highest rank; and it becomes an incident in the history of this fish to trace the progress of this upward-tending indulgence. From the persons already referred to, it first extended to some gentlemen who had been appointed Commissioners for the management of the affairs of an expanse of water, which had broken in on the low ground from the Thames, at Dagenham; and who, once a year, made it a custom to have a friendly meeting and dinner, of which this fish formed an important part, at what was called the Breach house; and to which they invited their particular friends, together with the principal ministers of the crown. Thus become a mark of gentility, it grew into a practice for all the inhabitants of the city who can afford the expense to indulge in the excursion down the river; and it is a sign of the conclusion of a session of Parliament when the ministers of the Cabinet go down the river in state to indulge in this relaxation.

The Whitebait has not been recognised as an inhabitant of the open sea, although for about half the year it is there only it could be found; and it cannot live even for a short time in fresh water. Yet it seems to delight in what is brackish, and in it a fishery is carried on with a small net, somewhat on the principle of the stow-net for sprats, being suspended from the side of a boat in the tideway in a small depth of water. This net is kept open against the current with rods, and is not lifted out of the water when the fish are to be taken on board; but as it tapers and is only shut at the end with a cord, this portion is opened and the fish removed from time to time, after which the net is again left to float on the current. These fish usually begin to come up on the tide at the end of March, or early in April; but in the year 1864, they were caught at the very beginning of March, and the fishery does not end before the conclusion of September.

It was formerly supposed that the Whitebait was the early stage of the growth of the Allis Shad, which then was also confounded with the Twait; and Donovan has represented this latter for the former. It was also believed that it was to be found only in the Thames, which last supposition could be regarded in no other light than as inconsistent with the former, since the Shad was known to shed its spawn in several of the other rivers of England. But the belief of its being only met with in the Thames is now also known to be an error; and Dr. Parnell discovered it to be not rare in the Firth of Forth, while in the south and west it has been obtained in Devonshire and Cornwall. I have been favoured with examples from the Exe, by Dr. Scott, of Exeter, and have also obtained them from the Fowey, in Cornwall; and there is scarcely a doubt that if looked for they might be found in every important river in the British Islands. Cuvier says they also exist in Germany, but we conclude that they are limited to districts where the climate does not extend beyond the borders of moderate heat and cold.

The time of spawning is supposed to be in and through the summer; and the very young are mingled with the more fully grown, so long as they continue to be caught in the river, a circumstance which seems to shew where the roe is deposited.

A large Whitebait has measured six inches in length, but they do not usually exceed four inches: proportions of the body nearly like those of the young herring, but a little deeper in comparison with the length, and more compressed than in the Pilchard; also more slender towards the tail. Under jaw longest, the gape full; teeth scarcely perceptible when fresh from the water, but existing in the jaws—an oval row on the tongue; also round the palate and along the vomer; the mystache extending to a line even with the centre of the eye. Where the gill-covers come together on the throat they form a sharp edge. Eye large; above the upper jaw a depression, from which the outline rises gradually to the beginning of the back; and when the fish is in good condition the elevation goes on to the beginning of the dorsal fin. Scales on the body large and closely set, but easily lost; and an obscure ridge of scales in eighteen sections from the throat to the vent. Dorsal fin behind the centre of gravity, with seventeen rays, the first ray a little anterior to the ventrals; the latter with eight rays. Anal fin narrow; tail forked, with nineteen rays; pectoral with seventeen. Colour along the back bluish or a rather dark ash green, which does not descend on the sides. All besides pearly white, but in some examples, as in those from the Exe, slight yellow on the sides. This description, and especially as regards the teeth, will serve to distinguish this species from the early growth of those with which it might be confounded; but a lens may be required in order to discover them. There is also no indentation in front of the upper jaw, as in the Shads.



ALLIS SHAD.

CCIV

ALOSA.

This genus is distinguished from *Clupea* by a recess in the middle of the line in front of the middle jaw; and however slight the mark by which they are separated, it is convenient as pointing out a family which differs in its habits from those of the genus *Clupea*, as now defined.

In almost all fishes in which the tail is forked, the upper and lower divisions act in some measure as separate fins, their action being often in opposite directions; but in the *Clupeæ*, or Herring family, the separation of the lobes is particularly conspicuous; and in the genus *Alosa* it is still wider, the separation being marked with a difference of structure; at which part there are two peculiar fan-shaped rays, which must have a different function from those above and below. At this part the body is only moderately covered with scales generally; which renders the structure of our scale-tailed species the more remarkable. The air-bladder is long and slender, and the tube which connects it with the vent is even more slight than in the Herring.

ALLIS SHAD.

SCADINA. ALEWIFE. DAMIN HERRING.

Shad,	Willoughby; Plate p. 3, f, 2, *Agonè*, and p. 227, but he confounds this species with *A. finta*, the Twait Shad; as do many others.
Clupea alosa,	Cuvier. Jenyns; Manual, p. 438.
Alosa vulgaris,	Yarrell; Br. Fishes, vol. ii, p. 213.

This species is widely distributed in the moderately temperate regions, and in the Mediterranean appears to have attracted attention at an early date; as it is noticed, under the name of Thrissa, generally by the writers on Natural History among the Greeks and Romans.

Of the Trichaios, which is our Shad, Aristotle says, B. 8, C. 13, that it enters the River Ister, or the Danube, and then, where this river divides into branches, it passes down into the Adriatic Sea; and in proof of this his argument is, that it is seen to enter the river, and is not known to come out of it again; whereas in the Adriatic they are not known to enter, but are caught as they come out. Aristotle could not have been acquainted with the geography of the higher portion of the Danube, and he may have given credit to the error contained in the received accounts of the proceedings of the Argonautic expedition; where instead of what really happened, which evidently was, that in order to escape pursuit the ship was conveyed across the Isthmus of Perecop, from the west side of which the adventurers sailed along by the mouth of the Danube into Greece, it was believed that they had gone up that river, and by some other branch had passed down to the Adriatic; a supposition which in somewhat later times gave rise to the further absurdity of believing that Ulysses had gone from Troy to the distant region of Italy, in his endeavour to reach his home in a Greek Island. It is plain that this wanderer had gone into the Black Sea in his endeavour to escape the danger threatened to his fellow warriors; and it is there the dangerous islands, from which the Argonauts had so narrow an escape, were his Scylla and Charybdis, and another island was the home of his Circe, where Medea had learnt her skill in sorcery. But the Roman Pliny, in a later age, had become acquainted with the geography of these regions; and therefore while he copies the Natural History of the learned Greek, he is compelled to add, that the passage of this fish from the Danube to the Adriatic was by subterranean channels; for he was aware that it accomplished at all it must be by a way not known to observation. Indeed, it does not appear probable that the Shad is at all accustomed to ascend to the higher part of this river; since Dr. Reisinger, in his account of the fishes of Hungary, does not mention this species as coming within his knowledge. They avoid turbulent streams or rapid currents, unless for a short way; but whether foul or clear is of small consequence.

It was also known to the Egyptians by ascending the Nile from the sea, and it is common along the coasts of Europe up to the north of England, but it is not mentioned by Nilsson as occurring in Sweden; although the kindred Twait Shad is found there. And this circumstance of its absence so far to the north agrees with the observation of Aristotle, that the Thrissa was not an inhabitant of the Euripus, as not being able to bear the cold. It is probable that what brought it into particular notice in ancient times, in addition to its habit of passing up the larger rivers from the sea in the spring, and soon again disappearing from view, was its supposed disposition of being particularly liable to the impression of sounds; especially such as are of a pleasing nature. It was the popular belief that they might be brought together by music; which opinion is recorded by Ælian and other writers, and strongly countenanced by Rondeletius in his own experience; and it was further supposed that they were so affrighted with the roar of thunder, as to be driven by it back again from the river into the sea.

There has always been a diversity of opinion about the quality of this fish as food; but this is known to depend on the place where they are caught, and the length of time they have been in the river; for when taken in the sea they are little valued, and the multitude of small bones with which the flesh is studded, is sufficient to banish all pleasure in eating it when there is no delicious taste to counterbalance the annoyance. It was in this condition that Ausonius prefers to call it by its more vulgar, but now recognised name, and pronounces it as notoriously unfit for any other table than that of the common people; "who does not know those frizzing, sputtering fish on every poor man's grate!

Quis non——norit
Stridentesque focis opsonia plebis alausas?"

But in some rivers a change of quality is soon effected, and then it is esteemed a fit repast for the epicure. Those of largest size are said to be found in Spain and the south of France, but the most delicious of the foreign rivers are those of Italy, and especially of the Tiber. In our own country the Severn has long possessed the character of affording Shads of a high degree of excellency, for which a regular fishery is carried on, of so much value that it forms one third, or, according to some evidence, an half of the profit derived from the fish of all sorts that is there taken. The season is in April and May, and the improvement in quality is quickly after the fish have entered the river; where they are caught in nets, of the length of about two hundred yards, with a mesh of three inches; and from seventy to eighty dozen have been caught in a night, at which time the fishermen are chiefly at work; for the Shad is a shy and timid fish, and might not be easily enclosed in a net by day.

It spawns in about the first half of June, and for this purpose they do not proceed very high up the river; it being very uncommon to find them so far up as Worcester; the chosen situations being shallow and rocky, and the proceeding is conducted at night, at which time the fish may be heard to make a rattling noise, as if beating the water with their tails. Presently after this the quality of the flesh suffers much change, and they speedily leave the river for the sea. It is to be observed, however, that I have found the roe of large size in the first days of February, fully enlarged in April, and also at the end of June. When at sea they are sometimes caught with a line by those who are *whiffing* for Pollacks; the bait being either the Mud Lamprey, or a slice cut from the side of a Mackarel; but it has been also caught in a trammel, which shews it sometimes to swim near the bottom.

This species is said to reach the length of three, and even four feet, but this must be where it is not often caught, and in consequence where it has had time to reach its full stature; and a Shad of half that size is what is mostly met with in England. In shape it differs from the Herring in being deeper in the body, and one from which our description is taken, and which was caught in the Severn, measuring fourteen inches and a half in length, was three inches and a half in depth. Head and body compressed, the latter covered with rather large scales to the root of the tail. Jaws equal when closed, but the latter protruding a little when the mouth is slightly opened; teeth obvious in the upper jaw, on each side of the recess in front, and also further on the sides; none in the lower jaw or on the tongue. Mystache running back to the hindmost line of the eye, narrow at first, then broad, broadly channeled, the border plain. Nostrils in a depression nearer the snout than the eye. Eye moderate; plate on the top of the head flat. The gill-covers adorned with branched lines—perhaps mucous ducts. The usual hooked serrations along the line of the belly. Dorsal fin over the ventrals, with twenty rays; the first two short; pectorals eighteen; anal fin narrow, twenty-one rays, the last two from one root; ventrals nine rays. Colour of the back blue, upper portion of the head brown; light golden tints on the gill-covers and about the upper parts round the eye, tints of blue and pink reflect on the sides, silvery below; a large black spot close behind the upper border of the gill-covers. Pharyngeal bones very slightly rough.

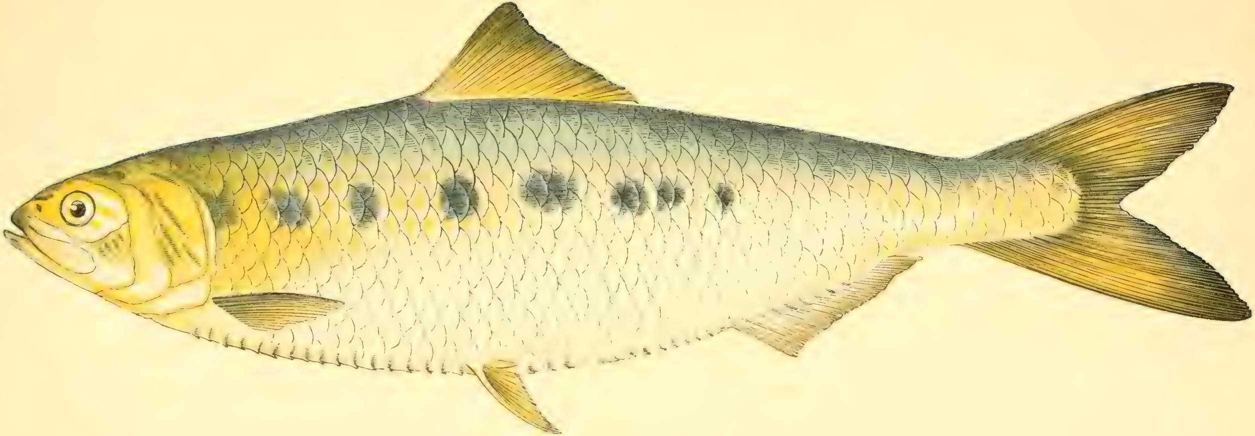
TWAIT SHAD.

MAID.

Shad,	WILLOUGHBY; p. 3, f. 1, p. 227, but he confounds the two now recognised species together.
Clupea alosa,	LINNÆUS. BLOCH; Pl 30. DONOVAN; Pl. 57.
" *finta,*	CUVIER. JENYNS; Manual, p. 437.
Alosa finta,	YARRELL; Br. Fishes, vol. ii, p. 208.

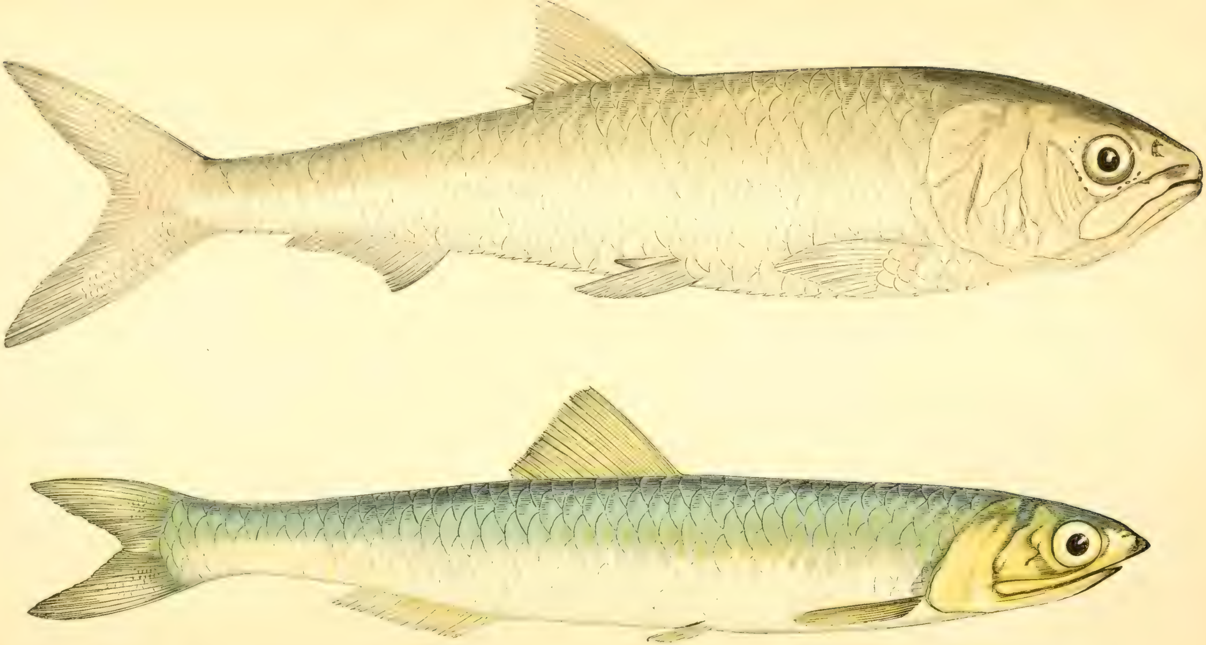
THIS species so nearly resembles the Allis as to have been confounded with it until Cuvier established some definite marks of distinction; the chief of which are the existence of some teeth in both jaws of the Twait, and that it is ornamented with a row of rather large spots along the sides from the gill-covers; whereas in the Allis there is only one spot, and sometimes none. In most other particulars they resemble each other, except indeed that the Allis is a little the thickest, and the Twait never reaches the size that is sometimes attained by the kindred species. Their habits are much alike, but the Twait is known further north, and is reckoned among the fishes of Scandinavia. It is also mentioned by Risso as a native of the Mediterranean, and in Britain, where it occurs, it is in more abundance than the Allis; but I have not known it to take a hook, although I suppose it to be the species from the stomach of which Dr. Fleming informs us he took three Herrings. It enters rivers in spring, and is taken in the Severn at the same time with the Allis; but it is in much less esteem than that fish for the table.

In what I suppose to have been an example of this species, instead of a row of large dark spots, I have noticed a scattered row of small spots irregularly placed on the sides.



THE SHAD

CV



1. SCALE-FINNED SHAD. 2. ANCHOVY.

SCALE-FINNED SHAD.

Alosa Squamopinnata, NOBIS.

Two species only of the family of Shads have been supposed to be found on the coasts of England and of Europe; but the fish I now introduce to the notice of British naturalists will be found different from the preceding species in so many particulars, that I am compelled to believe it a distinct species. The skin of it, with a figure, was sent to me from Bristol, by E. T. Higgins, Esq., where his attention was directed to it as it lay in the market; and our representation is taken from this only known example. But as when it came into my possession the colour had much faded, it has been judged best to give it in the plate with only so much of its native hue as then remained on it. Its length was one foot four inches; the depth a little more than three inches, the proportionate length therefore exceeding that of the Allis and Twait Shads. The scales also were much larger; but the more remarkable particulars are the peculiar distribution of the scales on the pectoral and caudal fins, in the former of which a larger series lies on its root, and extends over about half its length. On the tail the surface is generally covered with small scales, except the outermost ray above and below; and on the middle rays the scales are much larger than on either side. The pointed scales along the lower line of the body were not easily counted because of the large scales which overlapped them, but with some care we have represented them. These prominent points between the ventral fins and vent were fourteen, and there was the same number of ribs between the throat and ventral fins. On the back also the large scales conceal the roots of the rays of the dorsal fin. A large portion of the scales of the body had been lost; but enough remain to shew that there had not existed a row of spots as in the Twait; nor could any teeth be discovered in the jaws. The lower border of the mystache was not rough or toothed. Number of fin-rays—in the dorsal seventeen, anal twenty-four, ventral ten. Scales prevented the counting of the pectoral and caudal rays.

It becomes a question whether this fish has been overlooked by naturalists and is new to science, or whether it be a variety of the Allis Shad, from which species however it differs in too many particulars to permit us to allow of its being no other than a casual variety. The discovery of a second example would settle this question.

GREAT-HEADED SPRAT.

Clupea macrocephala, SWAINSON.

IT was the opinion of Mr. Swainson that he had discovered in the River Mersey, where it existed in some abundance, a distinct species of *Clupea,* which he denominated by the name quoted above; but although many years have passed, no naturalist has hitherto recognised it, or even referred to it in any manner. We notice it here in order to shew that we have possessed examples from the same neighbourhood, which have answered nearly to Mr. Swainson's description; the chief difference being that we did not observe "a few curved teeth in the palate;" and there could not be a doubt that they were different from the Common Sprat; but it did not appear quite so certain that they were not in an early stage of the growth of one or other of our well-known Shads, and probably of the Allis Shad; the heads of both the Shads seeming to be decidedly larger in proportion to the body at an early date, than in the full-grown condition of these species.

ENGRAULIS.

The snout projecting; mouth opening backward considerably beyond the eyes; mystache long and straight. Twelve or more rays within the gill-covers, the opening wide. Abdominal line without the projecting hooked scales as in *Clupea* and *Alosa.*

ANCHOVY.

Encrasicolus,	Willoughby; Table p. 2, f. 2. p. 225.
Clupea encrasicolus,	Linnæus. Donovan; pl. 50.
Engraulis encrasicholus,	Cuvier. Fleming; Br. Animals, p. 183.
" "	Yarrell; Br. Fishes, vol. 2, p 217
" "	Jenyns; Manual, p. 439.

The Anchovy has been best known in Britain as forming an esteemed relish when brought pickled and preserved from the Mediterranean, where a successful fishery has been carried on for taking them from remote times. This fishery is referred to by Ælian, who says that on one occasion so large a school was taken that fifty fishing-boats were loaded with the produce; and he adds that the Anchovy is prolific, very timid, and so fond of keeping in considerable bodies that it is not easy to cause them to separate, even by force. The same account is given by Oppian, with some tendency to poetical exaggeration; and it is probable he is referring to even the same remarkable instance as that given by Ælian, when he describes the taking of a large quantity with a ground-sean; but it is worthy of notice that whilst the simple narrative of the first-named writer represents them as prolific, the poet adopts the popular opinion of their having their origin from the froth of the sea.

The Anchovy is not numbered with the fishes of Madeira by Mr. Lowe, but Dr. Pappe obtained it at the Cape of Good Hope; and on the north of our own country Mr. Peach has procured it from Herring nets at Wick, in Scotland. It is found also in the Baltic, and by Nilsson along the coasts of Scandinavia. Fabricius also reports from Greenland that he had found examples in the stomachs of seals, and that they are caught in Davis's Straits at a long distance from land. In the westmost portion of the British Channel these fish are often taken in drift-nets employed in the fishery for Herrings and Pilchards; but this is only when they are sufficiently large to become entangled in the meshes as these chance to be doubled together, and there is sufficient evidence to shew that if nets of finer twine, with meshes of proper size, were employed, sufficient might be taken on the coast of Cornwall to supply the full amount of what is consumed in our own country, the whole of which, as sent to us from the Mediterranean, has been so much as, with a tax on the importation of twopence in the pound, to bring into the exchequer year by year the sum of £1,764. As regards the time when these fish are near us, I have met with an example in March from the stomach of a Mackarel; in summer they are found at St. Ives, in the ground-seans employed in catching Launce. Mr. Dillwyn mentions them at Swansea in June, and they have been found heavy with spawn in September, as also in November, and sometimes they are seen so late as December. But it is only in the Mediterranean, which they are supposed to enter from the Atlantic for the purpose of shedding their spawn, that a fishery is carried on with the expectation of profit; the principal adventure being with drift-nets, to which the fish are attracted with artificial light, which is kept burning in an iron framework for the purpose. Duhamel describes at considerable length the fishery for Anchovies in the Mediterranean; the most successful method being to attract the fish by means of a light, and then to shoot a net at some distance round the boat that bore it. This plan was pursued with several boats in succession through the night, for even in moonlight it did not succeed.

The largest Anchovy I have seen measured eight inches in length; the sides and cheeks compressed, but round over the back; the whole length to the fork of the tail about six times and three fourths of the depth. Upper jaw projecting much beyond the lower, gape wide, mystache slender, passing much behind the line of the eye, sometimes notched along the upper edge; under jaw narrow, pointed; teeth in both; the tongue slight, pointed, firm; passage of the gills forward in the mouth. Eye large, towards the snout; nostrils open. Dorsal fin behind the line of the ventrals, with sixteen rays; anal narrow; pectoral low and small; ventrals also small. Tail forked. Colour blue on the back, lighter on the sides, silvery white below; sometimes there are crimson tints about the head and iris of the eye; the cheeks yellow. It is necessary to distinguish this species from another which has been confounded with it, but which is marked by a shorter snout and rounder profile. This last has not been recognised in Britain.

EXOCÆTUS.

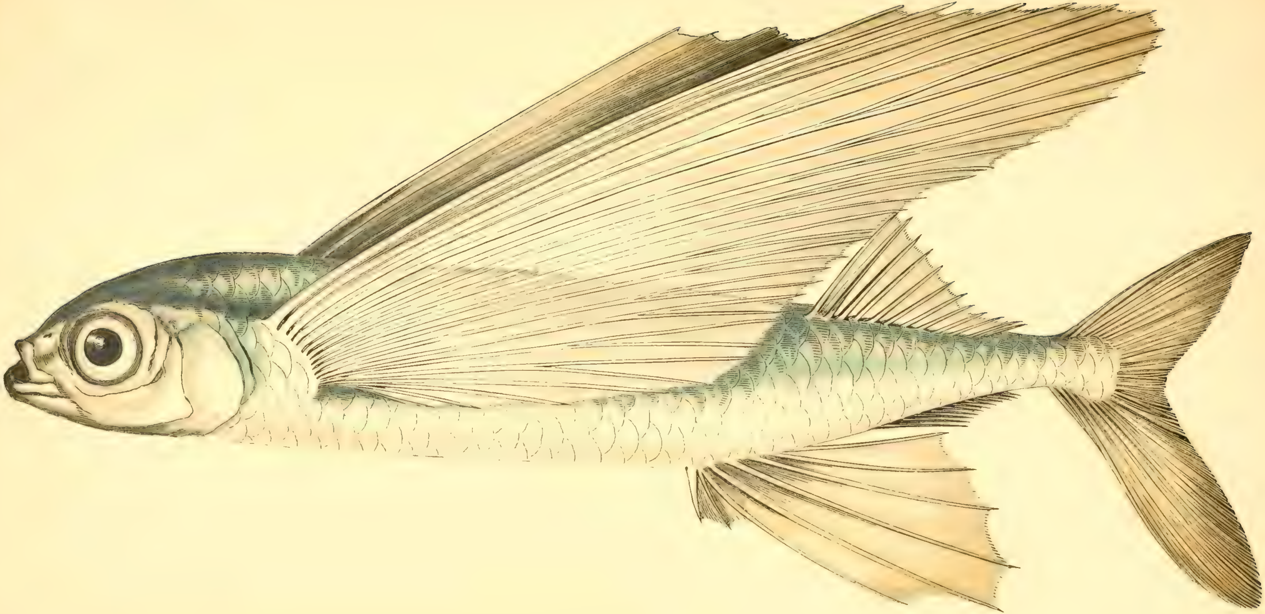
Body moderately compressed, and, with the head, clothed with scales. Low down on each side of the body a row of carinated scales, more prominent, and separate from the lateral line. Dorsal and anal fins far behind. Abdominal fishes; but what particularly distinguishes this genus is the very large extent of the pectoral fins, the rays of which are stout and firm; the arm bone or radius of this fin also large.

GREATER FLYING FISH.

Hirundo Plinii,	Jonston; Pl. 18, f. 5, pl. 17, f. 8.
Mugil alatus,	Rondeletius.
Hirundo,	Willoughby; Table p. 4, p. 233.
Exocætus exiliens,	Cuvier. Turton's Linnæus.
" "	Yarrell; British Fishes, vol. i, p. 458.

The earliest account we possess of the occurrence of a Flying Fish in Britain is by Pennant, who reports that in June, 1765, there was one caught in the River Towy, at a small distance below Carmarthen; whither it had been brought by the tide which flows as far as that town. He had not himself seen it, and as at the time when Pennant wrote his "British Zoology," it was not understood that there existed more than one species of Flying Fish, except indeed the Flying Gurnard; he therefore saw no reason to doubt that the representation he has given, and which he must have derived from some preserved example, was a correct figure of the fish; although in fact it is a likeness of the Lesser Flying Fish, *(Exocætus volitans,)* of which we entertain a doubt whether it has at any time been seen in our seas.

A second example of a Flying Fish is recorded to have been found on the beach at Helford, near Falmouth, scarcely dead, and still fresh from the ocean; and from the dimensions of this



GREATER FLYING FISH.

CCVII

specimen given to me by its possessor, Mr. John Fox, of Plymouth, I have no hesitation in believing it to be the Greater Flying Fish referred to above. But if any doubt could remain it must be set at rest by the examination which I had an opportunity of making of one which had thrown itself on the quay at Plymouth, and which came immediately into the hands of the gentleman who then possessed it. In the month of October, 1849, another of these fishes was left by the tide in Stonehouse Pool, in the harbour of Plymouth; and it is at this time preserved in the museum of the Institute at that town.

The faculty of flying, or rising aloft to a considerable height in the air, is such a remarkable character in fishes, that it has always excited attention in those who have observed it, and who have considered it an amusing incident, which served to lessen the tediousness of a long voyage over an expanse of ocean that is little diversified by other occurrences. But although to a casual observer it has an appearance not much unlike the corresponding action of a bird, and it has been more closely watched by attentive students of nature, it still remains doubtful whether the flight is to be ascribed solely to a vigorous impulse, impressed by the muscular power of the tail on the water, with perhaps the help also of the ventral fins, or whether some sustaining motion of the expanded pectoral fins may lend assistance in seconding the action of the other fins as it passes through the air, in addition to the gliding motion which, by its peculiar structure, is proper to it, and prevents a sudden fall or abrupt descent, until in the course of a lengthened journey it again alights obliquely on the wave. It has been the latest decision of naturalists that the impulse obtained by the action of the caudal fin, as it quits the sea, is the cause of all that is observed in the air; but there are some considerations which, in adopting this opinion, have scarcely been taken into account; and some of the actions of these fishes appear to imply that the expanded fins are not without their use in modifying and impelling, as well as sustaining the flight; in probable support of which opinion, Captain Tuckey, in his Voyage to the Congo, remarked a movement of the fins of a fluttering kind as they rose from the surface.

The observations we give are from several sources, some of which are derived from books, but others have been obtained from original and attentive observers who have many times sailed across the widest expanse of ocean; with the drawback, however, that it is probable the remarks have in either case been made on different species of this family; for it is far from certain that the kinds of Flying Fishes which are known to naturalists are all that exist in nature. Still however, as there is a general agreement in the mode of flight of all that has been observed, our notes on this subject can scarcely fail to be applicable to that one which is the special subject of our consideration.

Flying Fishes are generally gregarious, and it will sometimes happen that when perhaps not greatly alarmed, they will do no more than scatter themselves widely along the surface of the sea; but even when prepared to rise into a lofty flight, they will first take two or three shorter leaps before the stronger effort is made; and then the buoyant creature is carried so high, that it has been known to come in contact with the sail of a ship at the height of forty feet. Humboldt is of opinion that this is not always for the purpose of escaping from enemies; for they are seen to move onwards by thousands straightforward, and always in a direction opposite to that of the waves.

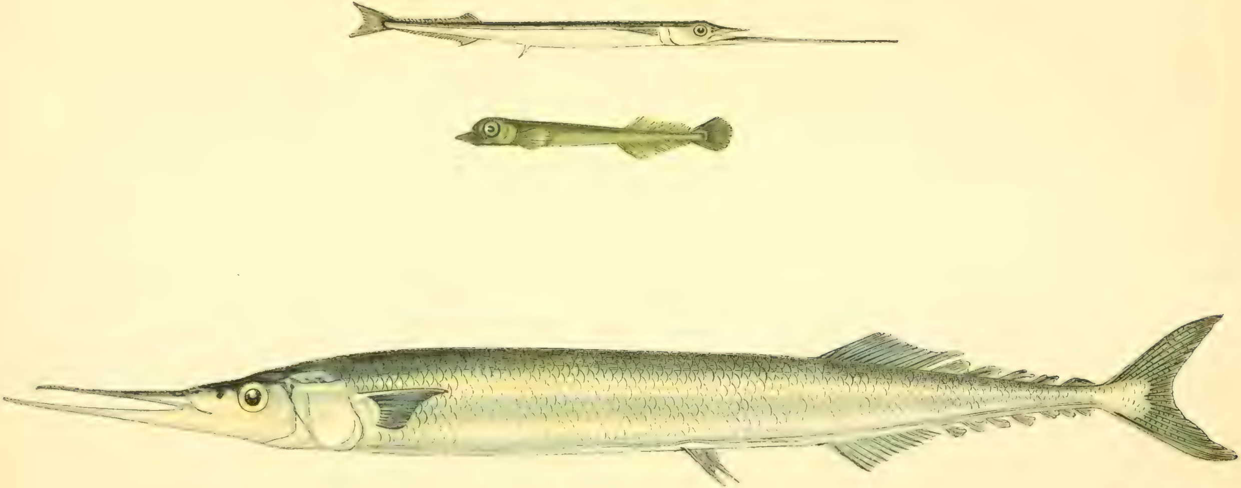
The time during which the flight has lasted has been measured as amounting to thirty seconds, and an observer has informed me that he believed it to be nearly a minute; during which the distance passed over has amounted to two hundred yards—an enormous extent to have been executed by a single leap; and so much the more worthy of remark, as that the strength of this little fish has been so little exhausted by it, that on falling on the sea it has been seen to rise instantly again in two or three successive flights of somewhat diminished distance. Swainson has observed that in rising they sometimes fly off in an obliquely angular direction from that which they took at first, as if they were under an influence by the wings and tail after they had mounted above the water; and we know how slight is the flutter to be noticed in the wings of many birds, where no doubt is entertained that a sustaining and guiding power is in operation, separate from that which only suspends them in the air. The mechanical structure of the pectoral organs, presently to be described, will lend some support to this suggestion; and the want of power to vary the course of flight either upwards or sideways, will offer little difficulty to this view of the case, when we recollect that in the most rapidly-flying birds the course for the most part is influenced by the tail, which in the fish can have no material effect in the air. It should not be forgotten that an hindrance to a more extended flight in these fishes has been supposed to arise from increasing dryness, and consequent stiffness of the fins, from the heat of the air as it exists in the climates where these fishes are chiefly met with. But examination shews that such is not the case; for such of them as have fallen on board of ships in the warmest and driest regions, are found to have maintained the softness and flexibility of the membrane of their fins for a longer time than is occupied by their utmost flight.

A more probable cause why contact with the water is sought after a lengthened flight, or in the midst of it, is the need of renewing the moisture of the gills for the purpose of breathing; while another effort at escape is forced upon the persecuted animal, by the appearance of some eager foe that may have watched its progress through the air, and is waiting to receive it into its jaws. Nor does the air itself afford a certain refuge from its enemies; for there it is watched for by the albatross and frigate bird, with several others; the formidable beaks of which are employed usually in the descending curve of the fish's flight. It is usual in merchant-ships to spread canvass, with outriggers over the side, at night to receive such fish as may spring from the water, and strike against the ship. In the morning it is the duty of the boys to examine this trap, and sometimes a considerable number are thus obtained as a welcome dish for the table. Amusement is also afforded by making a not very exact likeness of this fish, but with expanded wings; and this is hung from the bowsprit, so as that in the motion of the ship it may at times be dipped for a moment below the surface; and to seize it in its descent the eager Bonitoes rush forward to their own destruction.

Within a definite range the species of this family are great wanderers, but, according to Risso, the Greater Flying Fish pursues in the Mediterranean a regular migration; in the course of which they arrive in schools in the neighbourhood of Nice, in May, in their progress eastward, and continue for about a month; Dr. Gulia also recognises it at Malta. It does not appear that they are at any time caught with a hook; and their food is supposed to be the very small molluscous and crustacean animals which are known to abound at times in every part of the ocean.

I have possessed an example which measured twenty inches and a half in length, but that which furnishes the description is only sixteen inches, and as Rondeletius remarks, excluding the fins, the general form bears a near resemblance to that of the Grey Mullet The head wide, flattened between the eyes, which are large; the mouth wide across, but the gape small; lower jaw beyond the upper, teeth in both scarcely perceptible; nostrils close before the eye. The body round and wide across the back, compressed at the sides, more compressed and slender towards the tail. Scales rather large, with a separately marked line of them passing low down on the sides from beneath the root of the pectoral fin, to the root of each ventral. These do not form the lateral line, which, however, is only faintly marked. The first plate of the gill-cover passes backward below in a blunt angle. Pectoral fins wide, high on the body in proportion to other abdominal fishes, and in the example described nine inches in length, with fifteen rays, which are thin and branched, but broad, and the thin edge in contact with the membrane; the membrane also thin, and I am informed that when newly from the water it is transparent. These fin-rays lengthen to the fourth. Ventral fins long and wide, with six rays, the first short and wide, and when stretched back it reaches so far as to cover the beginning of the anal, in which particular, among others, this species is well distinguished from the Lesser Flying Fish, (*E. volitans*,) in which these fins are comparatively small, as also placed more forward on the body; although not so much so as is generally represented in published figures. The third and fourth rays of these fins are the longest, and they admit of great expansion. Dorsal fin far on the hind part of the body, high at first, then narrower, and the last rays lengthened. The anal begins opposite half the length of the dorsal, of the same shape, and they end opposite each other; the rays of both simple. The tail forked, lower lobe longest. Colour bluish grey, or dark on the back, pale blue on the sides, white below.

The structure of the organs of flight in these fishes, and particularly at their union with the body, is exceedingly interesting, as might be supposed from the use to which they are applied. Owen remarks that the bone equivalent to the radius in higher animals is of enormous size; but the description is given more at length in a paper on *E. volitans*, by Thomas Brown, in the sixty-eighth volume of the "Transactions of the Royal Society," (Part the Second for the year 1778.) He says, the united ends (of the rays of the pectoral fin) are grooved or hollowed, to receive a ridge or protuberance of the scapula, (or blade bone,) forming a joint of little motion except backward and forward, allowing the fin in one case to lie close to the side, and in the other to form an acute or right angle with the body, but without being necessarily expanded; (and thus the size of the fin is not a hindrance in rapid swimming.) From near the backbone downward to the bottom, where it ends in a point behind the gills, the body is strengthened on each side with a flat bone; both firmly united together at the place where narrowest, but as they become wider upward they grow hollow on the side next the body; and towards the gills the edge on each side is turned outward, so as to form a lodgment for a strong muscle; and on the hindward part is the articulation with the fin. Close above the joint, the bone he terms the scapula is hollowed in the shape of a crescent, in order to allow the passage of a tendon from a small muscle which lies in its lower part next to the body of the fish. The upper part of the ridge which forms the joint, and is received by or articulated with a fin, is somewhat enlarged and round; and over it the strong tendon, which is bound down by a ligament, together with some fibres of the muscle lodged under the inverted edge of the bone, is obliged to pass; and then passing over the joint, becomes inserted into the root of the uppermost and strongest fin-ray; and near the same place, a little way beyond the joint, is also inverted the tendon which passes along the semilunated part before mentioned of the scapula as over a pulley. These two muscles have their action upward, but in opposite directions; and thus the fin becomes expanded and raised; while the lower portion of it is kept down by an opposing influence on the hindmost and lower muscles of the body. There are other muscles also of smaller size which cause this fin to move backward and forward; and the whole apparatus of flight is so applied to the other organs of the body, that the scapula and fin with all the appliances of muscular structure can without difficulty be divided, except at the upper part, from the other muscles which form the foremost portion of the body of the fish; for the connection of the former is only constituted by a portion of cellular membrane. The eye of these fishes is so formed and placed as to take in extensive but not distant vision; and the muscles which move the eye are more distinct, firm and strong, than is generally the case in fishes. The air-bladder is large.



[illegible]

2. BLUNT-HEADED HALFBEAK. (Ma[illegible] . SKIPPER.

[illegible]

HEMIRAMPHUS.

Abdominal fishes, the body lengthened; the upper jaw very short in comparison with the lower, and formed by the intermaxillary bones. Lower jaw of considerable length, with teeth only so far as it meets with the upper jaw.

EUROPEAN HALFBEAK.

EUROPEAN HEMIRAMPHUS.

Hemiramphus,		Couch, in Trans. Lin. Soc., vol. xiv.
"	*Europæus,*	Yarrell; Br. Fishes, vol. i, p. 450.
"	"	Report for 1847, of Nat. Hist. Society of Penzance.

Many years ago, while engaged in taking Prawns in the harbour of Polperro, a small fish was observed at the surface of the shallow water with such an appearance of action as seemed unusual. It was easily caught, and on close examination appeared to be very different from any that had been known hitherto in England. The example was scarcely an inch in length, and therefore might well be judged to be in an early stage of existence; but as the figure was made out, it was described in a communication to the Linnean Society, as above quoted, as belonging to the only genus then recognised in which such fishes were arranged by Linnæus. But a doubt rested on the subject, in consequence of the fact that only a single example had been met with in any part of Europe, and this of very small size; and it was urged that the parent fishes must before this have been discovered, if such had ever come so near us, as the existence of so young a one would appear to imply. Several years had passed after this first discovery without anything further having come to light, when the original supposition appeared to be confirmed in an accidental research on the coast of Essex, reported by Dr. Clark, of Ipswich, by which a considerable number of similar fishes were obtained; some of which were sent to Mr. Yarrell, and from which a figure and description were derived, as contained in the second edition of his "History of British Fishes." Again on a later occasion, Mr. William Laughrin, A.L.S., of Polperro, obtained a sight of a considerable number of these fishes, similar in size to those mentioned by Mr. Yarrell, as they were in active movement in one of those large pools on our rocky coast, which are alternately left and covered with the tide; and he amused himself in watching their actions, sufficiently near to be assured of the exact form of these fishes, although he was not in possession of means by which to obtain them.

But in addition to this I have been favoured with a communication from J. S. Martin, Esq., of Weymouth, who kindly sent me two examples, which I have closely examined, and of which I took a figure with a description, which will be brought into connection with that of another presently to be mentioned of much larger size, of the taking of which I shall presently give an account. Mr. Martin informs me that the two sent were a portion of eight examples which were obtained alive in the Isle of Wight, in the month of August; and although six of them died soon, two of them lived for a time, and one survived for a week, during which it swam in a lively manner at the surface of the water among floating seaweed, with the appearance of enjoying the bright sunshine. These examples were about two inches in length; but even at this size it has been supposed they might be no other than an early stage of the growth of the Common Garfish; for some naturalists were not at all disposed to believe that any one species of a usually tropical family could have come habitually to the British coast; and even to an eastward part of it for the purpose of shedding its spawn, and that too without the parent fishes having been discovered; and the difference of length in the upper portion of the jaw was judged to be only the primitive condition of that organ in the well-known British fish. The fact that these little Halfbeaks were found to have their bones of a green colour, like those of the Garfish, was supposed to add much probability to this supposition; but the question has been set at rest, first, by the discovery of the young of the Garfish of no larger growth than the smallest of the Halfbeaks referred to, but with the upper jaw of the fully proportioned length of the full-grown fish; and again by the discovery of an example of much larger, and we believe, adult growth, in which the disproportion in the length of the jaws was more decided than even in such examples as had before been met with. From this example also it will be seen how it happens that a fish, whose habit it is to keep at a distance from land, cannot have been taken in nets, the meshes of which are of the usual size for other fishes.

It was on the 11th. of September, in the year 1847, that some driving boats were at the distance of four or five leagues from land, in weather inclined to be stormy, when a wave broke into one of them; and when the first rush of water had subsided, a fish was found to have been thrown on board, which was immediately wrapped in a piece of cloth; and it was brought to me as soon as the boat had reached the land. As regarded it there could not be a mistake, although this example differed in the length of the protruding jaw from such as I had seen before; and it is from this example that our figure and description are derived; with the addition, as we have said, of some notes from others already referred to.

The length was three inches and a half, the general figure slender, as represented in the plate; from the angle of the mouth to the point of the lower jaw one inch and about an eighth, which is a longer proportion than in other specimens I have seen, and in Mr. Yarrell's figure of another of my own. The eye large and silvery; head flat; angle of the mouth depressed, but the gape straight anteriorly; nostrils large, in a depression close in front of the eye; upper jaw short, pointed, with teeth along its length; lower jaw furnished with teeth only so far forwards as corresponds with those of the upper jaw; beyond this plain, without a furrow. The teeth are perpendicular to the jaws, straight, not very closely set, long for the size of the fish, but not of regular height. Lateral line straight. Colour of the back bluish, separated from the side by a defined line; side and belly silvery. Pectoral fins high on the side, somewhat lengthened and slender; in which it differs from those of the Garfish, which are proportionally shorter, wider, and not pointed; the fin-rays nine. Dorsal and anal fins far behind and opposite, reaching to the origin of the tail; but in the examples received from Mr. Martin, the anal was a little in advance of the dorsal; rays in the former nineteen, in the anal twenty-two. Tail concave. In Mr. Martin's fishes the upper jaw was arched or humped where it joined the head, which was not the case with other examples. The elevated line of scales which passes along the border of the belly on each side in the Garfish is not visible, even with the aid of a lens, in this Halfbeak.

The special use of the remarkable formation of the jaws in this fish can only be guessed at; but the observations of Mr. Swainson seem to be appropriate:—"It is a remarkable circumstance that we have a genus of birds equally unique in its own class, where the mouth is similarly constructed; in Rhyncops, or Skimming Terns, the upper jaw in fact is considerably shorter than the lower; and these birds skim along the surface of the sea to feed upon those minute animals which are only to be found there. This well-authenticated fact throws considerable light upon the probable habits of these fishes," which we are led to believe, "habitually feed much in the same manner." It was particularly noticed in the little example while alive that the upper jaw only was seen to move.

BLUNT-HEADED HALFBEAK.

Hemiramphus obtusus,	Zoologist, January, 1848.
" "	List of British Animals in the British Museum, 1851.

In the summer of the year 1841, I discovered, swimming in a pool of the rocks, where they had been left by the tide, several of the little fishes presently to be described, and of which we give a figure; and an account of these examples was read before the Linnæan Society in the following year. I have not seen any fishes like them since the time here mentioned; but in the year 1846, some of a similar kind were obtained from a pool in the Mount's Bay, near Penzance, by my late son Richard Q. Couch; and an account was given of them, with a figure of my own specimens, in the "Zoologist," as above referred to. My impression at the time was, that they were the young condition of some unknown species; but I have not been able with any probability to assign them to any kind of fish known to naturalists; and the account is here given in the hope that future observation will throw some further light on the subject.

The length of my own specimens was half an inch; the head proportionally large, wide across; body slender; eye large, and the snout in front of it short and abrupt; upper jaw arched; under jaw stout, projecting to a considerable extent, but in some specimens more than others; the point declining, and the sides not appearing to be formed of parallel rami of the jaw, but rather of a cartilaginous substance; vent placed posteriorly; body equal from the head to this point, but tapering thence to the tail; lateral line, so far as it could be distinguished, straight; dorsal and anal fins single, posterior, opposite each other; the latter beginning close behind the vent, and both reaching nearly to the tail; their membrane at first broader, but narrowing in its progress; pectoral fins and tail round. Ventral fins small, and very obscure—to be seen only in the larger specimens. The colour in different specimens varied greatly—from dark with a tint of green, to yellowish green and cream-coloured, with specks.

SCOMBERESOX.

Both jaws slender, and extended to considerable length; furnished with slender teeth. Scales on the body, and a line of them of keeled structure along each side of the belly. Several separate small fins above and below between the dorsal and anal fins and the tail. Abdominal fishes.

SKIPPER.

SAURY. SKOPSTER. MACKAREL GARRICK. HALIOU

Acus minor,	Jonston; Table 15, f. 15.
Saurus acubus similis,	Rondeletius.
Lacertus vel Saurus,	Willoughby; p. 232.
Esox saurus,	Turton's Linnæus. Donovan; pl. 116.
Scomberesox saurus,	Cuvier.
" "	Fleming; Br. Animals, p. 184.
" "	Yarrell; Br. Fishes, vol. i, p. 446.
" *Camperii,*	Risso. Bloch. Schneider; pl. 78, 2.
Belonè saurus,	Jenyns; Manual, p. 419.

This is a migratory fish, which comes to our coasts at the beginning of summer, and my earliest notes of its appearance, from the information of fishermen at the opening of the British Channel, are between the first week in June and the end of that month; and soon afterwards they spread themselves in companies round the United Kingdom, up to the most northern districts, where, in calm weather, they may be seen to afford a considerable degree of amusement to an observer. It may happen that the first appearance of this fish is announced by its presence in the shallow water of some of our harbours, in the pools of which it may be left by the ebbing tide, and it has been sent, with an inquiry as to its name and rarity, from a portion of a river so high that the water was fresh; but they usually keep in the open sea, where they are continually in motion, in doing which they are exposed to the fate, as in some degree they exhibit the habits of the Flying Fish, for which it is probable they have been mistaken by observers who have had no more than a general knowledge of the habits of these species. They are followed and persecuted by the Porpoise, and the more swift and energetic Tunny and Bonito, which appear to devour many of them; and in their eagerness to escape multitudes are seen to mount to the surface, to which the particular construction of the pectoral fin is well fitted to guide them, and there they crowd on each other as they press forward. Under the impulse of terror they spring to the height of several feet—leap over each other in singular confusion, and then again sink out of sight. But the pursuers again shew themselves, and they mount again, and rush along the surface for more than an hundred feet in a continued effort, without the body for a moment being lost sight of, and, as it would appear, by the instant but repeated touch on the water of the pectoral fins, and those which lie along the under part of the body.

It is this rapid and straightforward action which has procured for this fish the name of Sea Mouse, and which is so well described by the Greek writers Oppian and Ælian, as practised by a fish they have called Hierax or Hirax, the (Sea) Hawk, that I have come to the conclusion of its being the species formerly understood by that name. Referring to the creatures of the ocean that are able to fly, the Greek poet compares together the Flying Cuddle Fish, Sleve, or Kteuthis, Sea Swallow or Chelidon, and the Hirax, or Sea Hawk.

> When ravenous foes pursue they conscious rise,
> And court the kind protection of the skies.
> Far on unfeathered wings the Sleves are borne;
> Sea swallows lower fly. * * *
> But cautious Hawks, tho' winged, will nearer keep,
> And, hovering, o'er the wavy surface sweep.
> They rinse their moisten'd wings as close they skim,
> Both elements enjoy, and, flying, swim.
>
> OPPIAN.

And Ælian, B. 9, C. 45, so nearly says the same thing, that it might be supposed one of these writers had copied from the other. The Hierax, says he, is accustomed to raise itself so little above the surface, that it is hard to say whether it swims or flies. But, he adds, it is not always thus; and the Skipper will sometimes spring aloft to the height of perhaps a couple of yards, and thus pass over an arch of thirty or forty feet; and although this is very much less than that which is passed over by the flying Fish, already described, yet when we consider that there is no extent of wing to sustain the flight, the effort itself of reaching and passing over such an elevation must be regarded with surprise.

It was the opinion of the older naturalists that this fish was everywhere rare. Willoughby had never an opportunity of seeing it, and Rondeletius only as a curiosity sent to him, but of which he has given a characteristic figure. But these fishes sometimes come to the coasts of Cornwall and Devonshire in very large numbers; so that many thousands have been taken at once in a sean; but as they usually swim near the surface, they are at the present time taken in smaller quantities than formerly, in consequence of a difference in the manner of employing drift-nets for Pilchards. At no distant time these nets were made to float close to the surface, where they were exposed to frequent injury from the passage of ships over them; but at this time they are suffered to sink to the depth of two or three fathoms, which seems to be below the general range of these fishes. In the course of one year of the season, when Pilchards were sought for, the schools that appeared proved to consist of none but these Skippers, to the extent of several thousands at a single shoot of the sean or nets; for, contrary to their usual habits when in a body, they came near to the land; and it was the opinion of the fishermen that such an antipathy exists between these fish and Pilchards, that the presence of the former is an hindrance to a successful fishery of the latter. About the middle of autumn these fish again leave our coasts, and the latest I have any notice of was at the end of November, at which time they have become decidedly fat. As food it is not to be despised, and the taste is said to bear some resemblance to that of the Mackarel.

Repeated examination of the stomach shews that the food of this fish consists of a great variety of materials. Sometimes it consists of entomostraca, or such small crustaceous animals as are in an early stage of the larger crustaceans, and which abound through the warmer seasons of the year; but I have also found pieces of small red sea-weeds, and even of the marine vegetable *Zostera marina*, with small stones; and as this *Zostera* is not known to grow anywhere out of harbours, in which fresh water mingles with that of the sea, it is to be concluded that this fish sometimes comes to such a situation in search of food. In a rare instance it has also been taken with a hook, where the bait was made to imitate a living prey; and a description of the jaws will shew that they are not ill calculated for seizing an active object, and to hold it fast.

The usual length of this fish is from ten to about eighteen inches; the body slender, deepest opposite the beginning of the back. In the example from which our figure was taken, which measured ten inches and a half from the point of the lower jaw to the fork of the tail, the depth in a straight line was one inch; but in its fattest condition the depth is nearer the ventral fins. The head slopes forward from the nape; eye rather large; and in the example described the jaws projected before the eyes two inches and a half, the lower a little beyond the upper. This is sometimes described as turned up, but most frequently it ends straight, and sometimes it occurs turned a little downward. There are teeth in both jaws, but in the upper they are singularly placed; very small, numerous, close set, and spreading along the edge, so as to resemble on a small scale the teeth along the border of the Saw-fish Shark; and as when the lower jaw moves downward, an influence is exerted on the upper, so as to raise it as on a hinge, the grasp is wider than at first sight may appear; in this respect bearing a near likeness to the structure and use of the same parts in the Garfish. Nostrils in front of the eyes, placed in a recess of firm structure, resembling a mystache. A row of seventeen blue dots along the margin of the first gill-cover, which, on close examination, are seen to be pores. The body covered with scales of rather small size; and along each side of the belly a row of them of different form, as there is also in the Garfish, and less conspicuously in the Flying Fishes; the use of which is to serve as a point of support for muscles, from which additional strength is exerted for those lively actions by which all these fishes are distinguished. The pectoral fins are small, pointed at the upper part, and so constructed as to give the head an upward direction with a slight effort when swimming in haste; the rays thirteen or fourteen. Dorsal and anal fins far behind, and opposite, eleven or twelve rays in each; ventral fins a considerable distance before the vent and anal fin, with eight rays; and behind the dorsal and anal fins are finlets, which vary from five to seven in number; tail forked. The scales are easily lost, and then the skin appears more or less of a deep green; but when unhurt the back is a fine blue, the belly silvery tinged with blue; and from the upper line of the gill-covers to the tail there passes a broad line of silvery white.

BELONE.

The ventral fins abdominal. Body lengthened, slender; both jaws lengthened, slender, with teeth along their sides. Dorsal and anal fins far behind, and no finlets. A line of raised scales along each side of the belly.

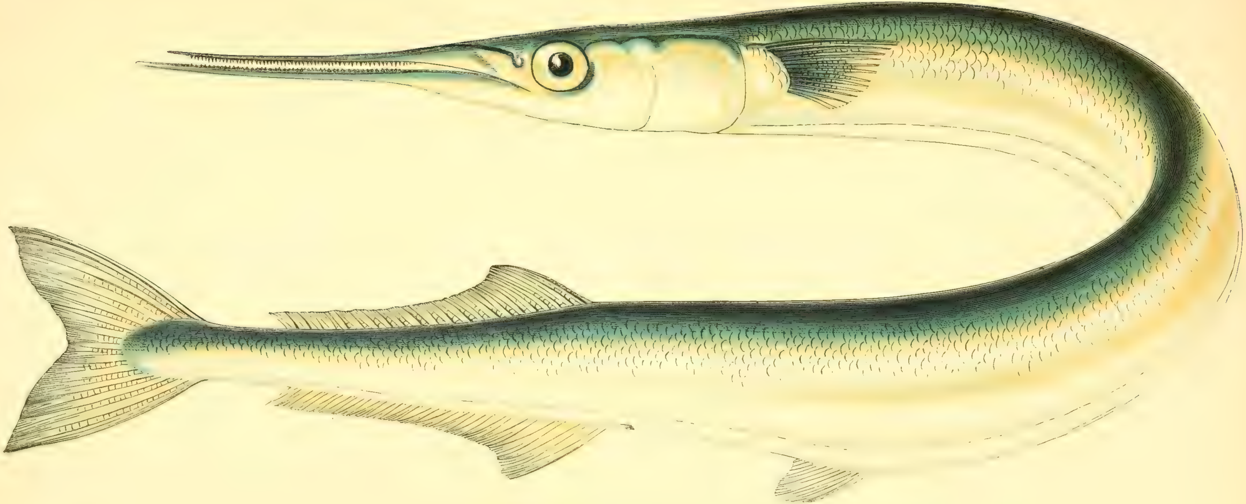
GARFISH.

LONGNOSE. HORNBEAK.

Acus Oppiani, Acus alia,	Jonston; Table 15, f. 17.
" " " "	Willoughby; p. 231, Table P. 2.
Esox belone,	Linnæus. Bloch; pl. 33.
" "	Donovan; pl. 64.
Belone vulgaris,	Cuvier. Fleming; Br. Animals, p. 184.
" "	Jenyns; Manual, p. 418.
" "	Yarrell; Br. Fishes, vol. i, p. 442.

On the coast of Cornwall this fish is common at all seasons, as also in the Mediterranean, and more sparingly, according to Mr. Lowe, at Madeira; but as spring advances it extends its wanderings northward, so as to be known along the borders of Scotland, Sweden, and Norway, in which latter country Nilsson says it is a common remark that when the Garfish appears in spring it is a sign of a dry summer. In the north, however, its visit is only transitory, and it returns to the south in winter.

But wherever found it is a restless and wandering species, and having a quick digestion of food, it is always prepared to seize a bait, which it grasps with a peculiar action of its protruded jaws, presently to be described; but as the action of swallowing is not usually so sudden as in many other kinds of fish, when the boat is passing on rapidly under sail, the



prey becomes torn from it in a manner well known to fishermen. But when again the hook is felt in the gullet, the Garfish does not seek to escape by darting away, but, as if conscious only of the annoyance from the restraint of the line, it will mount to the surface, even before the fisherman discovers that he has had a bite; and there, with its body partly out of the water, it struggles with the line in a variety of active contortions.

The feeding of this fish appears to be indiscriminate, for whatever of an animal kind it can seize and swallow; but it feeds also on a black fly which alights on the sea in fine weather, and sometimes its stomach is filled with them. I have taken Herrings of about one third the full growth from their stomachs, a single one in each; for it will not hold more, and the passage is straight to the vent.

There are times also, when the sea is calm and smooth, that it may be seen engaged in solitary amusement at the surface, or perhaps many together, by leaping again and again over some floating object, as a rod or straw; or it may thrust itself bolt upright out of the water, to fall back again in an apparently clumsy manner. It is an amusement with fisherboys to throw some slender stick to the Garfish, when it will execute a variety of evolutions about and over it as it floats.

The roe is of full growth from the beginning of January to about Midsummer; and Nilsson says that the season of spawning is three times in the year, but not with the same individual fish. The largest spawn first, and so in succession to the youngest. We have already shewn, when speaking of the European Halfbeak, that in their early stage the young may be distinguished from those of that fish by some decisive marks; and they appear to be of quick growth, so as to be from six to nine inches in length by the month of October.

On the east and south coasts of England there are fisheries for the Garpike, with nets, which are shot by night from small boats; but which are received on board a larger boat that attends them, if the weather becomes stormy. But this fish is not much valued as food; although it meets with a sale in London and some of the larger towns, and where known it is as welcome a dish as some that are elsewhere highly valued. Among fishermen it is for the most part cut in pieces and used as bait. Perhaps the strong and disagreeable smell that proceeds from it when newly caught, may be the reason of its being little regarded for the table.

This fish attains the length of about thirty inches, but the example described measured only twenty inches, and the greatest depth, which was at the ventral fins, an inch and a half. The jaws protrude beyond the eyes three inches and a half; upper jaw more slender than the lower, and not quite so long. The two branches forming the lower jaw are united by bone, which is crossed with rough bony bars; and the upper jaw is equally united into one, but without bars. Two rows of teeth in the upper jaw, of which the inner row is much the most prominent; in the lower jaw a single row. In the mouth a fleshy pad in front of the tongue, which with the remarkable structure of the nostril, in a pit, with a free fleshy process and large nerves passing thither, shew it to be of quick sensation after prey. Eye large; upper part of the head hard and bony. Body moderately compressed, with scales, and a ridge of them of peculiar form passing along each side of the belly through the whole length; acting as a point of support for muscular effort. The body becomes more slender opposite the dorsal and anal fins, which are far behind and opposite each other; more expanding at their origin, and ending short of the tail, which is forked. Pectoral fin short, upper rays longest; ventrals distant before the vent and front of the anal fin. The colour brilliant blue on the back, slight tints of blue on the fins, all besides brilliant white.

The articulation of the jaws is characteristic. The upper jaw is joined to the frontal bone by a strong ligament, which admits of free motion. A process of this upper jaw also passes down to the angle of the mouth; being covered by a mystache formed of a bone corresponding to what anatomists term the *os unguis*. The interior part of this process is joined by a ligament to the raised edge of the lower jaw; this ligament also admits of free motion. But the proper articulation of the under jaw is below the eye, to what from that circumstance perhaps may be called the temporal bone, but which is the first or lowest gill-cover. The effect of this structure is, that the depressing action of the lower jaw is the cause of the lifting of the upper jaw; and that, too, to a greater extent than the lower, by a kind of action not common to many fishes. The simplicity of this structure for grasping is equal to its effectiveness.

The bones of this fish are of a light green colour, which some naturalists have supposed to be produced by the action of boiling in water. But it is the same when the fish is alive, as it is also in the European *Hemiramphus*, and, as Mr. Owen informs us, in the *Lepidosiren*. It in reality resides in some minute channels that pass through the bones for the purpose of nourishing them. Professor Owen further remarks that this is the only known fish in which a cup and ball joint is found at the ribs; all other fishes having two cups, which meet at their rims, with fluid interposed between them.

I have met with a curious irregularity in the formation of the lobes of roe, which were of no more than half the usual length, but four in number instead of two; and one of them at least had no communication with the common outlet, but seemed to communicate with the entrail.

ESOX.

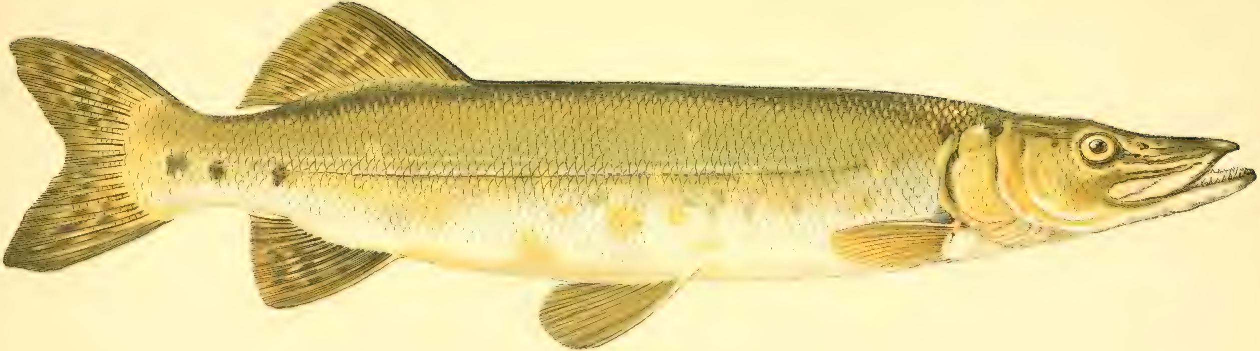
The snout protruded, broad, and somewhat flattened; gape wide, the palate, throat, and sides of the lower jaw thickly armed with prominent teeth. Body lengthened, dorsal and anal fins single, far behind and opposite each other. Abdominal fishes.

PIKE.

JACK.

Lucius,	Jonston; Table 29, f. 1. Willoughby; p. 236, Table p. 6.
Esox lucius,	Linnæus. Cuvier. Bloch; Pl. 32.
" "	Donovan; Pl. 109. Fleming; Br. Animals, p. 184.
" "	Jenyns; Manual, p. 417. Yarrell; Br. Fishes, vol. i, p. 434.

The Pike has been long popularly known as characterized by an eager and almost indiscriminate appetite, accompanied with great boldness in all that relates to the satisfying of its cravings; and numerous stories illustrative of this are recorded in books of Natural History. We will quote a few of these, from writers that are less accessible to readers in general, in order to shew this predominant disposition of what has been termed the tyrant of the lake and stream; and in which its voracity equals, if it does not exceed, even that of the generality of Sharks; although from its more limited powers and opportunities it does not usually display them on the higher animals or man. The naturalist Jonston quotes Rondeletius as saying, (what I do not find in my copy of that author, A.D. 1554,) that a friend of his had stopped on the border of the Rhone that his mule might drink, when a Pike seized the animal by the lower lip, and held it so fast, that as the animal started



backward the fish was lifted out of the water and secured. Another of these fishes was known to have seized the foot of a young woman as she held it naked in a pond.

A more modern instance of similar ferocity is given from Mr. Pennell's "Angler Naturalist," as quoted in the "Athenæum;" and the half-starved condition of the fish in this case will help us to understand the influence which was at work in the other instances, to drive these fishes to the remarkable manifestations of boldness reported of them:—A young gentleman, "aged fifteen, went with three other boys to bathe in Inglemere Pond, near Ascot race-course, in June, 1856; he walked gently into the water to about the depth of four feet, when he spread out his hands to attempt to swim; instantly a large fish came up and took his hand into his mouth as far as the wrist, but finding he could not swallow it, relinquished his hold, and the boy turning round, prepared for a hasty retreat out of the pond; his companions who saw it also scrambled out as fast as possible." He "had scarcely turned himself round when the fish came up behind him, and immediately seized his other hand crosswise, inflicting some very deep wounds on the back of it; the boy raised his first bitten and still bleeding arm, and struck the monster a hard blow on the head, when the fish disappeared." Seven wounds were dressed on one hand, "and so great was the pain the next day, that the lad fainted twice; the little finger was bitten through the nail, and it was more than six weeks before it was well. The nail came off, and the scar remains to this day. A few days after this occurrence one of the woodmen was walking by the side of the pond, when he saw something white floating." It was found to be a large Pike in a dying state, and he brought it to the shore, "and the boy at once recognised his antagonist. The fish appeared to have been a long time in the agonies of death, and the body was very lean and curved like a bow. It measured forty-one inches, and died the next day. There can be no doubt the fish was in a state of complete starvation. If well fed it is probable it might have weighed from thirty to forty pounds." In Dr. Crull's "Present State of Muscovy, (1698,)" mention is made of a Pike that when taken was found to have an infant child in its stomach.

A more ordinary occurrence has been the seizure of ducks and half-grown geese as they swim; and even a couple of young geese, with a waterhen, were found in the stomach of one of these fish. It has also been known on some occasions to seize and devour one of its own species almost as large as itself. When this occurs, however, the whole body of the prey cannot be received at once into the stomach; and the devourer has been seen with the tail and a portion of its victim protruding from its mouth, until by the dissolution of a part, there is room afforded for the remaining portion to be in turn subjected to the powers of digestion. With such perpetual craving it may be supposed that where they exist the defenceless inhabitants of the river are enormous sufferers from their depredations; and so rapidly do they pursue the anxious flight of their prey, that Jonston was himself a witness to a Pike's having thrown itself into a boat in the eagerness of the chase. But notwithstanding the voracity which so strikingly distinguishes this fish, we are not to conclude that it does not exercise some degree of choice in its food, or that some amount of fear or caution does not mingle itself with its boldness.

The frog is a favourite morsel; so that it has been said there is no croaking in that department of a pond where the Pike seeks concealment; but it will not touch a toad, or if on some particular occasion the fish has ventured to swallow it, the hateful morsel is presently thrown up; as it is known to do also with other disagreeable food. It is generally believed that it abstains from seizing the Perch, and also the Stickleback, through fear of the bristling spines with which these fishes are armed; and it is said to abstain also from the Tench, as if from some dislike of the slimy covering of its skin; but this has been ascribed to the higher motives of love or gratitude, a sort of feeling little likely to be felt by it, notwithstanding poetic authority in its support; and indeed more prosaic observation asserts the opposite of such a self-restraint.

In the "Zoologist" volume for 1853, p. 4125, the Rev. W. T. Bree says that he "turned into a pit fifty-seven small Tench and upwards of three score Crucian Carps; and not a great while afterwards, having discovered the presence of Pikes in this piece of water, a net was employed, with which three of that species were taken, which weighed respectively about three pounds, two, and a pound and a half; but all that remained of the other fishes which had been placed in this pond were one Tench, that weighed a pound and a half, and eight Crucians of about a pound each;" and he adds, "I cannot have the smallest doubt that the Pike devoured the fish that were missing, and these nine that remained only escaped because they were rather too large for these Pikes to swallow." But in addition to this, the same gentleman remarks, that in fact the Pike is *doubly* destructive of Tench, as well as of other fish, "not only devouring such as are of a size suitable to the capacity of his jaws and stomach, but also by seizing, mutilating, and finally destroying others which are too large to be so disposed of."

The formidable array of teeth in the mouth of the Pike must present an effectual barrier to the escape of any prey when once it has been grasped within the jaws; but this armature is of further use in crushing the life from the creature that is seized; and then it is conveyed away to a retreat, in order to its being passed into the stomach in a more deliberate manner.

The usual haunts of the Pike are in the stiller waters of slow-flowing rivers, and ponds where weeds are growing; in which situations it lies in wait for any tempting prey that may come within sight, and from which it makes excursions in search of any living thing that may satisfy its hunger. On this it rushes with a violence well described in an extract given by Dr. Badham, in his "Fish Tattle," from which we quote it:—"Shrouded from observation in his solitary retreat, he follows with his eye the motions of the shoals of fish that wander heedlessly along; he marks the water-rat swimming to his burrow, the ducklings paddling among the water-weeds, the dabchick and the waterhen leisurely swimming on the surface; he selects his victim, and, like the tiger springing from the jungle, he rushes forth, seldom indeed missing his aim; there is a sudden rush, circle after circle forms on the surface of the water, and all is still again in an instant;" and in this manner it sometimes happens that a pond is almost wholly deprived of its most valued inhabitants, the solitary Pike being left, like some human tyrants, to reign and starve in gloomy grandeur over a kingdom destitute of inhabitants.

This fish is known in almost every part of England except Cornwall; and the lake or pond of Slapton Ley, in Devonshire, is the only part of that county in which I can find it has been taken. I have received it from the north of Ireland, through the kindness of the Earl of Enniskillen; and Mr. Thompson mentions several lakes in that kingdom in which it abounds. It is recorded also as a native of several rivers in Scotland. Over the larger part of the continent of Europe it is well known, and it is in abundance throughout Sweden and Norway to a high degree of latitude; where in the latter country, according to Linnæus, it is caught and preserved to serve as a principal portion of the subsistence of the poor people in winter. And although it is strictly a fish of fresh water, so that it can only live for a short time, and in a sickly condition in that which is altogether salt, it is also found in the upper portion of the Baltic, where the water is sufficiently diluted to allow it to thrive. Spain is not wholly without the Pike, as has been said by some; and it is an inhabitant of the temperate and colder regions of Asia, even so far as China, as also in America. It seems therefore a matter of surprise that this fish is scarcely mentioned, if at all, by the ancient writers of Greece and Rome; in the former of which we meet with no reference to it; and in the latter, if it be the *Esox* mentioned by Pliny, his only notice of it is, that in the Rhone it has been known to weigh a thousand pounds; which assertion, derived perhaps from popular report, is sufficiently wide of the probable truth as to encourage the doubt of its being the fish now known by the same name. Yet as a native of the Tiber it must have been known to the people of Rome; but their writers seem generally to have disregarded the natural living habits and instincts of the inhabitants of the waters, and to have viewed fishes as worthy of notice only so far as they ministered to the luxuries of the table, or again as they contributed some occult qualities to the impostures of medical magicians, who abounded in the city, and to the absurd pretensions of whom the higher classes of ancient Rome were accustomed to lend a willing ear. Ausonius, writing in the fourth century, mentions it as a fish of the Moselle; but this he does only to record a commonplace piece of wit, in reference to its vulgar name of Lucius; which signified one that was born in the early morning light, or, as interpreted, under favourable circumstances, and it was therefore greatly valued by the Romans, for having been borne by many illustrious men of that empire; in contrast with whom it appeared absurd to apply it to a fish of such little estimation.

It has been supposed that the Pike attains the age for spawning in three years, and that the youngest deposit their roe at the earliest season of the year, which may be in February or March; after which at successive intervals those of middle age and the oldest succeed them; the whole season continuing for about three months. These fish are very prolific, and we derive from Nilsson the following account of the probable comparative numbers of the grains of spawn to be found in fishes of the two extremes; comprising some whose living is procured from vegetables chiefly, or insects, and the ravenous devourer of the full-grown inhabitants of the fresh-water. Thus on the authority of Lund, there have been obtained from a Pike which weighed thirty-five pounds, two hundred and seventy-two thousand one hundred and sixty grains of spawn; from a Carp of the weight of three pounds, two hundred and thirty-seven thousand; and from a Tench of the same size, three hundred and eighty-three thousand two hundred and fifty. For a Salmon he reckons a thousand for every pound of its weight; but for the most part fish of fresh-water are less prolific than those of the sea.

The place of depositing the roe is not the same with the haunts of this fish at other seasons; but a regular migration takes place at the breeding season, in search of such smaller, more rapid, and clearer streams as will suit their purpose; and in doing this they will overcome difficulties that ask no little exertion. The spawn is shed on the cleanest weed, and presently afterward the parent fish return to the weedy nooks of the pond or river, in which they maintain their station during the remainder of the summer. It has been thought that the object of the parent Pikes in seeking for retired brooks in which to shed their spawn, has been to secure their helpless young ones from the depredations of other fishes, on which in turn they are destined to subsist; but if this were the motive their care avails but little; for the number of Pikes which reach maturity bears only a small proportion to the grains of roe that are shed. It is more probable, however, that they are guided by instinctive feeling to choose a purer water than that of their usual haunts, and a mixture of proper temperature with brighter light; the influence of which latter on the development of the smaller animals is well known. The young are produced in about thirty days, and their growth is rapid, but it is much slower as they advance in years, and yet without ceasing up to a considerable age; the full extent of which appears to exceed that of any other known inhabitant of the waters.

Lord Bacon supposed this fish to live for about forty years, and it has been reported to have been known to reach a hundred; but even this lengthened date must yield to the account given by Gesner, who says that in the year 1497, a Pike was caught in a lake or pond near Hailbrun, in Suabia; and attached to its gill was found a brass ring, of which a small part was still bright and shining, and of which he gives a figure with the inscription engraved on it. This was in Greek, and a translation of it is, "I am the first fish that was placed in this pond by the hand of Frederik the Second, Governor of the World, on the 5th. of October, 1230;" from which, adds this writer, we conclude that this fish had reached the age of two hundred and sixty-seven years. From the size of the ring, as given in the before-named figure, it is to be supposed that when placed in the pond it was not a small fish; and if it had not then been caught, there appeared a likelihood of its continuing still to live on for a considerable time. The diameter of the ring exceeded three inches and a half, with a breadth at the border of one fourth of an inch; and on its side was another ring one inch and five eighths in diameter, by which it appears to have been attached to the fish; while on the other side were fastened six round drops of metal as large as peas, each of which is fastened to the border of the principal ring by a short stem.

No small amount of curiosity has been felt in reference to the fact that Pikes have sometimes been found in newly-made ponds, where it is not known that they can have been introduced by human hands; and very different opinions have been advanced to explain the circumstance. Gesner ascribes it to the stork, which he supposes to have devoured the spawn of the fish, which afterwards has passed through the body of the bird undigested, and has come to life after it has been discharged into the water. In a report of the Meeting of the British Association for 1845, we are told that the then Bishop (Stanley) of Norwich, P.L.S., related several facts which went to shew that grains of the roe of Pikes were deposited in the thatch of a cottage, where they remained for some years; and then, when this thatch had been thrown into a dry ditch, that afterwards was filled with rain, young Pikes were seen to be produced. It is certain at least that Pikes of some moderate size will leave the river or pond in which they have lived, and travel over land to some other water; but this alone cannot account for the fact that these fishes in a very early stage of existence have been found in these newly-formed pieces of water, to which, from their very small size, we cannot suppose them to have travelled over land.

Much difference of opinion has existed in regard to the value set on the Pike for the table; so that while in some districts it has been highly valued, in others it has been thought scarcely worthy of notice. But this will not be deemed strange when we consider the effect produced on the generality of fishes by the difference of food, of water, and even by the colour of the soil; and their health is also much influenced by the season of the year; for the Pike is said to be in a high condition only through the summer, from June to October. That it was known and greatly valued in England at a time far preceding that in which Leonard Mascal is reported to have introduced it, may be seen in the Book of St. Albans; and it is mentioned also by Chaucer. It was also thought of sufficient importance in the reign of King Edward the First as to be made, with other fishes, a subject of that king's legislative meddling; and a further proof of the value set on the Pike, in company with Bream, is seen in an enormous feast given by Archbishop Neville, at his enthronation in the reign of Edward the Fourth, when six hundred and eight of these fishes, conjointly, were set before the guests, together with twelve porpoises and seals; but no other fish, properly so called, was thought worthy of the notice of the guests. It is probable however that the high price fixed on it at that time is to be considered rather as a proof of the prevalence of fashion than of the general esteem in which it was held; and it is further probable that it was the cost and skill bestowed on feeding it for the market, as we shall presently shew, that enhanced the price above that of many other fishes.

We have it on the authority of Gesner and other writers cf that age, that it was usual to cut open the belly of this fish to the extent of two or three inches, in the same manner as we have noticed of the Carp, in order to display to the purchaser its well-fed condition; and in this state it was preserved alive in the market, to be restored to its native element if a sale were not effected. It was under these circumstances of its being thus returned that the Tench was supposed to act as the physician, and by licking the wound to cause it to heal speedily. So lately as the time of Willoughby and Ray we are told that captive Pikes were kept in coops or wooden frames afloat in the river at Cambridge, in order to be fattened and in constant readiness for the market; and the price of one that was full grown, and thus in good condition, might amount to twenty shillings, although a Pike of smaller size would be sold for as many pence. I possess a memorandum of a Pike which, in March, 1752, was caught in Devonshire, in what the writer calls Slatton Pool, and which may be supposed the lake termed by Montagu, Slapton Ley; the length of which fish was two feet and nine inches, the weight nineteen pounds, and for which the price demanded was three crowns and a half. Three shillings were offered for it and refused; but on the following day it was sold for half a crown. But while the flesh of this fish may be deemed wholesome, and by some a delicacy, it has been said that the roe is dangerous food, and by some it has even been pronounced poisonous. We can readily believe that on some constitutions, and as an unusual food, it may act with considerable violence; but Linnæus, in his travels (Lachesis Lapponica) in Lycksele Lapland, informs us that it constitutes a part of the ordinary diet of the people of that country; where "the spawn is dried, and afterwards used as bread, dumplings, and what is called valling—a sort of gruel made by boiling flour or oatmeal in milk or water. The livers are thrown away, being supposed to cause drowsiness, and pain in the head, when eaten." The Pikes are dried by these people to serve as an important part of their subsistence in winter.

We forbear to speak of the methods employed in fishing for the Pike, since these may be found at sufficient length in books devoted to the art, from Izaak Walton in his various editions down to the latest date of such publications; which the gentle angler is never tired of reading and practising. But there is a trait in the habits of this fish which seems to require notice, as it has a bearing on a portion of the nature of all fishes, whether of the river or the sea.

The Pike is observed sometimes to remain asleep in some quiet part of the stream, with such an entire suspension of its senses, that opportunity has been taken of snaring it with a noose, and thus lifting it on shore. This fact is more worthy of notice, as the proof generally of the existence of sleep in fishes appears very doubtful; and at least, if it exists at all, it is conducted in them in a different way from what we perceive in all other classes of animals.

The Shark, Dolphin, and Pilot-fish will attend the devious motions of a ship for very long distances through a succession of numerous days and nights, without appearing to flag in their exertions, or to mistake the course of what they follow; which circumstances cannot be explained if during this time their consciousness of external objects had been suspended, or they had been asleep in the manner of other creatures. We can imagine it possible indeed that separate portions of the brain may fall into a state of sleep alternately, while others remain awake; but the apparently more probable supposition is, that their sleep is a condition somewhat resembling what we know of human somnambulism; in which state the external senses are partially awake, while rest has fallen on some important portions of them. There are instances where men are known to have acted with vigilant intelligence in some particulars, while much of their outward consciousness in other matters has been suspended; and so it may be with the inhabitants of the water; but the subject deserves more attention than it has yet received. This suspension of vigilance in the Pike as a proof of sleep is the more remarkable, as at other times its faculties are greatly on the alert, and its sense of hearing in particular is more acute than in the generality of fishes.

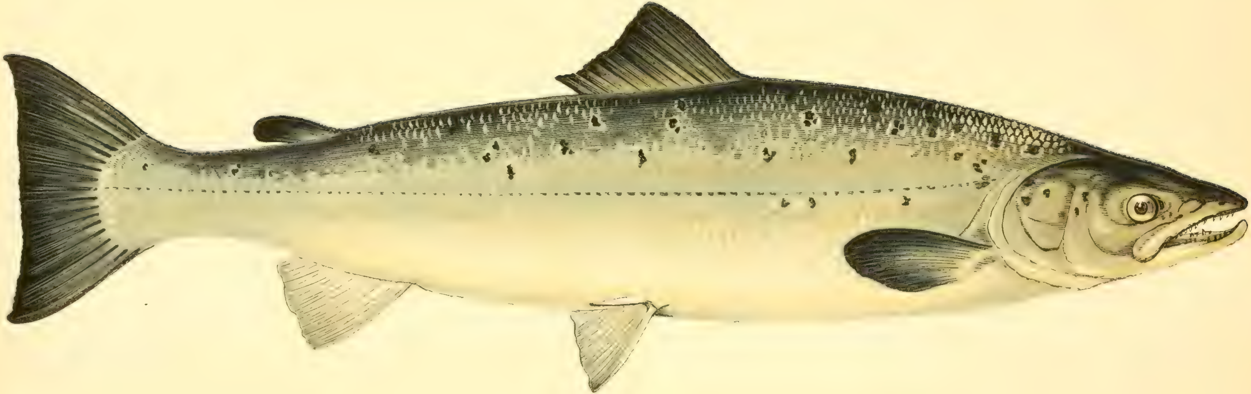
When suffered to reach its full size the Pike has been found of the length of five or six feet; and the aged individual mentioned by Gesner is said to have measured nineteen feet, with the weight of three hundred and fifty pounds. But the usual magnitude even of a large fish is much less than this, and Willughby thought it deserving of record that he had been present at the taking of an example which weighed thirty-two pounds. In contrast with this, however, in Ireland a fish of from twenty to forty pounds is not uncommon in the market; and I have been informed on good authority that at Castle Coole lake in that country a Pike was obtained which was not less than sixty pounds; and from the nobleman who communicated this fact I further learn than an example had been seen which was of the weight of seventy pounds. A note is given in the "Magazine of Natural History," of a Pike taken in Loch Lomond in Scotland, that weighed seventy-nine pounds; and to go still higher, in the supplement to Daniels' "Rural Sports," there is an account of the capture in the river Shannon of one that weighed ninety-two pounds. It was observed to have chased several Perch, which to save themselves from so formidable a devourer, had thrown themselves on the shore; but in its eagerness it had itself rushed into such shallow water as did not allow of its retreat.

Dr. Crull, already quoted, mentions an example which measured five feet in length; but although we have been favoured with specimens of almost a yard in length by the kindness of the Earl of Enniskillen, our description is taken from one that measured only sixteen inches. The general shape lengthened, moderately compressed, round over the back, more slender and compressed behind the dorsal and anal fins, which fins are far behind and opposite each other; the beginning of the dorsal a little in advance. Snout protruded before the eyes, depressed, becoming thinner towards the mouth; a large and strong mystache, which extends opposite the eye. Head flat and wide; under jaw longest, gape wide; teeth slight on the curve in front of the upper jaw with a vacancy at the symphysis; but a very formidable arrangement within a long, sharp, thickly-set bed round the palate, separated from those in front of the upper jaw by a fleshy curtain. Teeth on the middle of the palate (vomer;) tongue rough; under jaw with less prominent teeth in front, but large, long, firm, and sharp a little incurved at the sides; a formidable arrangement, from which no living thing that enters can hope to escape. Eyes prominent, with a row of obvious pores behind it; pores also round the under jaw; nostrils wide. The body covered with scales; some also on the cheeks behind the eyes, which also are prominent in lines high on the side, running to meet each other along the middle of the back. The scales on the belly appear as if sunk in the skin, and separate from each other. The gill-covers extend considerably backward. Lateral line little perceptible at first, straight. Dorsal fin with eighteen rays, of which the fourth is the longest; anal also with eighteen, the first three or four very short; the colour of both yellowish, with strongly marked black rays; pectoral fins low, under the throat, round, yellow; ventrals abdominal, but much anterior to the anal, yellow with a white border. Caudal fin broad, forked, with eighteen rays, the main stem of each of which gives off branches only on one side, which is that, above and below, which is directed towards the middle of the fin. Colour of the top of the head and back dark brownish green, yellowish green on the sides, with scattered yellow spots; white below; a broad band from the front of each eye; and other bands from below pass forward, converging to the sides of the snout. A remarkable structure in the eye of this fish, discovered by Mr. Drummond, (Charlesworth's Mag. Nat. Hist., vol. ii,) appears to shew a special power of regulating distances in sight, and in no British fish are the three bones of the ear (Otoliths) on each side so decidedly visible.

THE SALMON TRIBE.

This family forms the genus *Salmo* of Linnæus, and is characterized by the insertion of the mystache, or true maxillary bones, on each side of the snout or intermaxillaries, by a hinge; by the armature of the mouth, where the jaws and border of the mystache are furnished with teeth, as are generally the roof of the mouth, with also two rows along the sides of the tongue; and also by the presence of two fins on the back, of which the hindmost is small and destitute of rays. In this last particular the fishes of this family stand alone among the fishes of Europe; but there is something like it in some Indian species; as of the genus *Pimelodus*, which in this respect forms a link between the genus *Salmo* and the apparently very different genus *Silurus*. The armature of the mouth is less a mark of the extensive family of Salmons and Trouts, as there are some aberrant subgenera which have teeth less visibly in the jaws, or are altogether without them; but all are abdominal fishes, and within the body the air-bladder communicates with the gullet by means of a tube, the opening of which is clearly visible. As no visible nerve is seen distributed to the rayless fin on the back, this part seems to be only possessed of common and not specific sensation.

By Cuvier this extensive family is divided into several genera, of which on many accounts the first stands conspicuous.



SALMO.

A LARGE portion of the upper jaw formed by the mystache, which has teeth along its edge; teeth also on the intermaxillary bones, round the palate and in front of it; a double row on the middle line or vomer, and on the tongue. Ventral fins abdominal, opposite the middle of the first dorsal; the rayless fin opposite the anal. Internally, the air-bladder communicates with the gullet by an obvious duct.

SALMON.

Salmo,	JONSTON; Table 23, f. 1, Table 31, f. 12.
A Salmon,	WILLOUGHBY; p. 189.
Salmo salar,	LINNÆUS. CUVIER. BLOCH; Pl. 20.
" "	FLEMING; Br. Animals, p. 179.
" "	JENYNS; Manual, p. 421.
" "	YARRELL; Br. Fishes, vol. ii, p. 1.
" "	Fisherman's Magazine, Vol. i, No. 4.

THE Salmon's praises to my verse belong,
King of the streams and glory of our song.
He claims the rivers and he claims the seas,
Those for his summer's joys, his winter's these.
Now in the storm he stems the mountain waves,
And now the thundering cataract he braves;
Tivy or Wear; when remeant from the deep,
Renew'd in vigour he essays the leap;
Then springing with a bound surmounts the height,
Dashes the foam and glories in his might.
ANGLERS.

AMONG the fishes of usual occurrence in the British Islands there does not exist a family of which the minuter particulars of its Natural History, or even the precise distinction of species, is so little agreed on as that of the Salmon; and this state of ignorance, whether in scientific observers or in fishermen, is the more to be wondered at, as all the species are known to pass a large portion of their lives at no great distance from places of human resort; where also they have been long the subject of interested notice, in consequence of having been from a distant date regarded as an esteemed dish for the table, as well as an important article of trade; and these united circumstances have caused the Salmon to be the subject of a large amount of, it must be allowed, very unsatisfactory, if not contradictory, official inquiry and legislation.

It is additionally remarkable concerning the most valuable of this family of fishes, the Salmon itself, that the portion of its history which is passed in the more immediate neighbourhood of man has been far from the least obscure; and that too, although it has been the subject of much research and experiment. This state of uncertainty, however, especially as regards the distinction of species and the variety observed in their habits in different places, may in some measure be explained by the fact, that at the time when Salmon have been engaged in depositing their spawn, or soon afterwards, the same or a closely neighbouring spot has been chosen by individuals of a different, although kindred species; or that otherwise by the operation of violent floods, the eggs of more than one species have been mingled together; and in consequence of this the spawn of different kinds have become the subject of the same training. It is certain also from observation that in the early stages of their growth the marks of distinction between the species are so obscure, that the most attentive observers have found themselves at a loss in endeavouring to lay down such as they could depend on for separating them; and the difficulty is increased, that as each one advances in growth its form and colour are in continual change.

It was in consequence of these combined causes of uncertainty that when large numbers of the young fishes were caught in the river, and marked without discrimination, and afterwards set at liberty, that the confusion was made still greater, by taking them again as the Salmon, Sea-Trout, Bull-Trout, and even the Common Trout; of all of which no doubt is felt that they are distinct species. To keep clear of such mistakes as these, recourse has been had by later enquirers to more undoubted methods of research; the beginning of which has been to procure the impregnated roe immediately on its being shed, or even to press it from the body of the living fish, and then to pour upon it the vivifying fluid of the male; after which it has been conveyed to a pond or pool of running water, where the following stages of development and growth might be traced from day to day. Our knowledge of some of the habits and changes of the young of the Salmon has been thus extended; but with this arises the belief that from some perhaps scarcely perceptible influences arising from the small degree of deviation to which they have been subjected in their removal from the natural action of the river, as regards its depth, the nature of the soil, and other causes, including an unnatural manner of impregnation; the regular course of development has been interfered with; and as experience proves that the Salmon, perhaps more than any other fish, is thus liable to be influenced, it may in this manner be explained why it is that a portion of these young fishes should be ready to pass out of the fresh water early in the first year of their existence, while others of them, and it would appear, almost if not altogether exclusively, the males are not ready for this emigration before the second, or even the third year of their age.

As bearing on the same subject, it seems highly probable also that much difference will be found to exist between rivers not far distant from each other; and which from the variation of times in which they are visited by the fish are termed early or late; a knowledge of the causes of which is yet obscure, and to study them fully would demand an acquaintance with the peculiarities of every river in the kingdom. We shall have occasion to shew that in the rivers of the south and west of England no such delay is known in the departure of the young, as is reported in the north; and as it is also certain that some causes have operated to produce in different rivers considerable variation of shape and bulk, in addition to the season of emigration; as well as that also a retardation of growth has been effected to and beyond the third year by artificial means, the conclusion seems unavoidable, that there is some special circumstances which produce these variations, and that they may be obviated when the subject is better understood.

But there is a limit to every degree of variation in a living animal; and amidst the large amount of its changes there exists a sub-stratum of regularity of habit and action, which is derived from an intrinsic conformation of its parts, of which the nervous organization is the chief; so that, as we know the nerve of sight cannot be made to perform the function of the ear, nor the nerve of the latter that of the tongue; and also that the nerves of common sensation cannot supply the place of those which direct the actions of muscular motion, although no skill in the use of the microscope has hitherto been able to discern a difference in their structure; it follows further that the receptive brain in one species of animal is not capable of eliciting the essential thoughts or instinctive feelings which are the natural characteristics of another. It is probable that the ordinary nervous fibres of the body of every separate creature possess some specific or peculiar mode of action in the conveyance of impressions; but it is the central organ which gives them their proper tone, from which the character of the race is formed. It is among these constant characters of the species, as it is in a large portion of the family, that we find the Salmon is not able to sustain life under a heat of climate that shall exceed what is found within the temperate regions of the earth; and it is known to be most at home and in greatest abundance as we proceed towards the north; although there is a limit also in that direction, and our more common species is compelled to shrink from the biting severity of the icy sea. Thus although, as we shall have to shew, the roe of the Salmon is quickened into development in a shorter time in a mild climate, and by the application of a moderate degree of artificial heat, than when exposed to the icy cold of a northern river, and that the fish itself is so conscious of this as to refuse to ascend to its spawning bed when dissolved snow or floating ice is in the way, yet Dr. Davy has proved that in a heat above seventy degrees the young will not come to life.

Through Sweden and Norway to the further bounds of Scandinavia the Salmon is in plenty, together with other species not known with us; and in the north of Scotland, as also in the Orkney and Shetland Islands it is said to reach its highest degree of beauty and perfection. It is to be remarked, however, that perhaps from the nature of the water, and the food, with no little difference of climate, which may have impressed a large amount of peculiarity on the local varieties, the season of its chief excellency for the table is different, and even opposite in different districts; as are also the times and circumstances of its annual emigrations. In Scotland and the north of Europe, where the rivers are large, and in summer full of water from the moisture of the climate, without any mineral impregnation, the chief season is from early in the year to the end of summer; although, as already remarked, even this varies in rivers not very distant from each other. It is at this time that the fishing in the north is in its greatest activity, as well for sport as profit, while in the Severn the season of excellency is the opposite of this; and in Cornwall, with a large part of Devonshire, the fish is altogether absent until some time about the middle of August, but more commonly late in September; and it is only from October to December that the fishermen can follow their occupation with the prospect of profit; the consequence of this variation, therefore, is that in some districts the Salmon is in an acceptable condition for the table at a time when in others they cannot be obtained, or are not fit to be eaten. With the protection of the law as it now stands, this fish cannot fail to increase in number in some rivers, especially in the west of England; but as this abundance can only take place in what is termed the fence time, it can only be for the benefit of those who set the law at defiance, and to this therefore there appears an almost irresistible temptation.

It cannot be alone in obedience to sexual instinct that this fish is urged to seek the fresh water; for a large portion of them in the more frequented districts are known to leave the ocean many months before an enlargement of the roe can be discerned; and not less than nine or ten months before the time when they are expected to deposit it; and we shall have occasion also to shew how probable it is that there exists a different influence, which exerts a powerful impulse on the motions of these emigrants. This entrance into fresh water of a portion of these fish, and a portion only, and these in long succession, will begin to take place soon after the beginning of the year, and even at a time when there are breeding fish still engaged in the duty of shedding their spawn; and therefore considerably before the time when a large portion of these latter have returned to the sea; which they lose no long time in doing —the females before the males—when exhausted by that natural proceeding.

When drawing near the land they form themselves into companies, which sometimes include large numbers; but these do not consist of an incongruous multitude. By some of these the land is reached at a distance from their ultimate destination, so that they will have to pass along towards it by the windings of the shore; and their actions then are frolicsome, by often leaping out of the water to the height of three or four feet, and falling back again on their side without appearing to make a progress, or desiring to do it. But it has been often noticed that, however strange it may be they should find out each other, those only have become associated which belong to a single river; towards which they hold their way in some regular order, while each lesser division of which the host consists is so well acquainted with, and attracted to its own branch of the stream, that if not forcibly driven out of its course, it will quit the larger body, or pass by some inviting streams, to enter the favourite district in which it first saw the light; a circumstance the more surprising when we call to mind the early age at which many of them left it and their various wanderings afterwards in the ocean. It has been observed that the fish of two rivers which even lie near each other, when coming from the sea, are not accustomed to unite into one assemblage, but that they arrange themselves and proceed onward in separate hosts. But when these companies have reached the mouth of the river they are often seen to linger there; and then it is especially that they find enemies waiting for them in the Grampus, Porpus, and Seal, which inflict upon them no small terror as well as devastation. A cause of this delay may be a want of a sufficient quantity of water in the river, at a time perhaps when a warm season has brought them onward prematurely; and even the appearance of the sky, whether bright or gloomy, will have an influence. The prospect of a fall of rain is soon acknowledged and acted on; for it is surprising to perceive how quickly fish become aware of atmospheric changes, or even the prospect of them. But the hindrance may continue for a week or two, until a fresh rush of water excites them, and then they pass rapidly upward to the genial depth of the flowing stream.

According to the very precise account given us by Bloch, Salmon are accustomed to enter a river in two ranks, which form two sides of a triangle; and the stoutest fish, which is usually a female, leads the march, while at about a fathom behind her are two others; and in this order they proceed with all the others following, without being turned aside by any ordinary obstacle. This author says that the females go first, and next to them the stoutest males; so that if the fishermen begin by catching only small males, they conclude that the chief body has already passed on.

These fish give a preference to the middle current of rivers where they are not deep, unless when the weather is cold and boisterous; and a rapid river with a clean bottom is a favourite resort. Fishermen notice that they do not at this time swim deeper in the water than about six feet, and as they go up an estuary it is with the flowing tide, which carries them free from many obstructions; but if the current turns before they have made a satisfactory progress they turn backward with it, by which it may happen that they fall into danger, more especially from fixed nets planted there to intercept them, and within which they are left at the ebb tide to be taken up at leisure. This turning back of the Salmon at the ebbing of the tide is the more remarkable as when advanced beyond it the downward current of fresh water has not the same influence, nor even the violence of a cataract, against the force of which they seem to delight in leaping with a perseverance that is wonderful, and commonly with success. In this progress upward, however, their energy is not without intervals of rest, during which they continue in some deeper pool for two or three days, as if to recruit strength for another effort. The number of fish sometimes comprised in the host we have described may be guessed from the quantity that has been taken at a single haul of a net, and that even when the net has been of the ordinary moveable sort. Dr. Bathurst says, in his "Notes on Nets," that fourteen hundred and fifty-two were thus caught; and this amount has been far exceeded in some instances, when what we believe to be the more effectual or destructive nets have been employed. We are thus told that two thousand five hundred were secured at one time in the River Thurso; and in the Ribble, in the year 1750, three thousand five hundred of good size were taken at one *catch*, but it is not said in a single net, although it is probable they formed only one assemblage.

We cannot vouch for the constant occurrence of such a regular arrangement of this army as is described by the Prussian naturalist, since, if it at all exists, it must be liable to be broken up by the multitude of enemies and dangers to which these fish are exposed, and of which man and his engines are not the least formidable. But after they have entered the river it is uncertain how long they keep together since through the summer they are found single or in small parties, and accessions are made in continued arrivals, until, as the autumn advances, the newly-arrived fish present a different aspect, and are urged on towards a different object. It has been contended that of all the fish which come into fresh water from the early months of the year none return to the sea until they have shed their spawn, which function for the most part is only performed in the winter, or from about the month of November to January, although in some instances, and in particular districts, it may be so early as the latter part of September, or as late as in March. But there does not appear any proof of this long continuance of the individual adult Salmon in rivers, and the contrary seems more highly probable. Thus it is admitted that in a short time after it has entered the river an unfavourable change as regards its plumpness and delicacy as food is perceptible; and so speedily is this produced that some observers profess to be able to detect it in a few hours, and it is allowed to be visible after a few weeks, by which time also the parasitic animal which in the sea had fastened itself to the skin has fallen from its holdfast. But if so hurtful a change has taken place as can be discerned in this short space of time, we can scarcely suppose that the same fish will remain in such a healthy state for many succeeding months as is necessary to a successful effort of spawning, being also during that time exposed to a succession of the same depressing influences. We add, that there appears no means by which we can feel assured that a fish which is known to be in perpetual movement has not retraced its course to the sea, to be replaced by a new arrival, which circumstance is the more probable as it is known that the fixed nets employed at the entrance of rivers do just as frequently intercept those which may be coming down as those which are only moving up and down with the tide. It seems certain, also, from repeated observation, that after its arrival within the influence of fresh water, the Salmon, or its earlier condition of Grilse, does not increase in growth; and yet by careful examination it has been proved that the individual fish which have been weighed in September are of twice the bulk of those which have been taken in July. This is shewn by a table in the "Quarterly Review," (No. 226, p. 417, April, 1863,) and that the examples were not the same fish admits of no doubt, since the larger fish of the last-named date were bright in colour, as Salmon are when they leave the sea, whereas when these or the Grilse have been long in the river the colour becomes of a much darker hue, and the surface is charged with a greater abundance of slime. It also affords no small degree of support to the opinion that those Salmon which ascend rivers in the early part of the year do not remain in fresh water to its close, that in the rivers of Cornwall, and, for the most part, in Devon, where, unless prevented by a flow of water from copper mines, there is often a run of fish in the early months of the year, none are met with as the summer proceeds, nor do the young return in the form of Grilse, as in the rivers of Scotland. In none of these western rivers except the Tamar, and in this last but rarely,—to be accounted for by the depth of water which floats a mighty navy,—have I heard in a long series of years, (except in a few instances in the Fowey,) of a Salmon being caught from the early months of spring until towards the end of August. A very few only have returned late in August or in September, and it is only from October to the beginning of December that they have been in such numbers as to deserve the attention of fishermen.

It is chiefly in the last-named month that the milt and roe are enlarged, and it is the opinion of many that it is at the earlier stage of this natural process when the fish is in its highest perfection, as well of form and colour as of delicacy for the table. It is at this time also that it becomes the earnest endeavour of these fish to pass upward in the stream as quickly and as high as possible; in which last particular they are not satisfied until they have reached some place near the head, where the water is shallow, and runs with a steady force over a bottom of sand or gravel, in which situation there are natural advantages as well for the parents as the young; and in obtaining these the dangers incurred, and the difficulties to be surmounted, are lightly regarded, so that the length of the journey, which may extend to several hundreds of miles, seems only an addition to the pleasures of the adventure. The difficulties that are met with are produced by obstacles which sometimes are natural, perhaps in the shape of cascade that may be formed of a rush of water from the almost perpendicular height of a dozen feet or more; and strenuous are the efforts which the Salmon is seen to put forth, to make good its way upward from the deepened pool below.

Dr. Fleming says, in his evidence before a Committee of the House of Commons, that he has seen them leap up over a fall of thirty feet; but the spring out of the water itself seldom exceeded eight or ten feet; which must be considered enormous when we consider the impulse necessary to effect it in a fish of many pounds in weight; and he has also seen them leap over a dry rock so as to drop into the water behind it. We believe that sometimes a leap from below into the torrent as it falls will still enable the fish to surmount the difficulty; but more frequently this is without success, and the struggling creature is carried back again, if not, indeed, intercepted by a contrivance, referred to by Linnæus, of placing a basket in a situation to receive it, when hurried backward after an ineffectual struggle. It appears however that this failure of success is not always a proof of weakness; but it may be caused by the oblique direction in which the fish has fallen on the descending torrent, so that its side or shoulder became exposed to the force of the stream, which then it was not able to resist. The tail is the important organ with which these efforts are made, and when we examine its intimate structure we cannot fail to be impressed with the belief that this organ was especially formed for the purpose to which we find it thus applied; for in the generality of osseous fishes, if not in all besides this, the broader plates of bone to which the rays of the tail fin are attached, are placed opposite the termination of the vertebral column or backbone; but in the Salmon family this is not the case. On the contrary, the line of the joints of the vertebræ is lengthened out so as to be extended upward; by which means these caudal plates of bone are arranged and fastened along the lower border of the joints; by which contrivance additional power and flexibility of the bones and muscles are provided, together with a high degree of complex action in the impulse.

When the season has been deficient in rain, and the level of the water is therefore low, the difficulty in springing to the higher level is so much the more increased; and this is especially the case, as some considerable depth of water is required to serve as a foundation for the impelling power that is to secure success. It is then that the full extent of its exertion is called for, as it is described in the lines we have placed at the beginning of our history of this fish; and forcibly also by Ausonius in the description of his favourite river:—

> Nor will I pass the glistening Salmon by,
> With crimson flesh within, of sparkling dye:—
> An hidden impulse first disturbs the stream
> That silent flows; then upward darts the gleam
> At middle water: and the bounding fish
> Strikes with his quivering tail, in earnest wish
> To dart aloft.

Great has been the admiration of observers as they have watched this proceeding of a morning or in the evening, which are the principal seasons of exertion, while the repeated efforts will sometimes last for a considerable time, in consequence of repeated failure. But besides the natural obstructions here referred to, there are others which owe their existence to human contrivances, with the direct intention indeed of preventing the further ascent of the fish, in the selfish hope of making a spoil of the whole of these inhabitants of the river, without any consideration of the injury to be sustained by the brood, or the indignation felt by the dwellers on the banks above.

But in many instances a different spirit has been shewn, and wiser claimants of the right of fishing have provided means by which the fish may pass upward without the necessity of exhausting their energies in vain endeavours to leap above the artificial obstruction. This is effected by hewing a path in the rock, or building a sloping passage in a zigzag course, termed a ladder; with resting places, by means of which these active fish may find no difficulty or delay in the ascent; with the advantage also that the people who live along the upper portions of the river by obtaining a share of the profit, may become enlisted on the side of protection to the spawning fish, instead of destroying them.

It is the season of passing upward of the emigrants in the spring and summer, that forms the harvest of the proprietors of the river fisheries in the northern portion of the United Kingdom; and omitting for the present those methods of catching Salmon, which come under the nature of commerce, now is the time when the angler seeks his principal employment and pleasure; an extended account of which we find it unnecessary to give, both from the space it would occupy in our pages, and also because it is so well accomplished by writers who have made it the special object of their volumes; but of these perhaps the most pleasing and satisfactory that has come within our notice is by a gentleman, who takes the name of Ephemera, but who is said to be otherwise known as Edward Fitzgibbon, Esq. We may judge of the eagerness with which this sport is followed, when we read the frequent announcement of the temporary liberty of fishing to be let at rent for prices which must render the river more profitable to the owners than is the land through which it flows. It is bargained for in proportion to the number of rods intended to be used; and £150 are demanded for the privilege of fishing with four of these rods on a specified stream; with the addition, that those who use them must be of one family. In another part of Scotland the thrifty owner of the right of fishing demands for each day's amusement with two rods twelve shillings and sixpence, with the surrender to him of the fish caught, or one guinea if the angler shall retain what has fallen to his rod. It has been remarked that at these prices every Salmon that is taken will have cost £3 or £4 to the fisherman; but this is an erroneous estimate, and, on the other hand, the health acquired and the amusement obtained after long confinement amidst other pursuits, and in the confinement of a city, are to be considered as the proper equivalent for all the cost that is expended in the sport. It is to be regretted however that by the appropriation of almost every river in these districts, little space is left for the benefit of the casual and less wealthy angler; and even the more distant rivers of Sweden and Norway have been sought out and appropriated for the same purpose and at a similar cost.

But the energy and excitement with which the sport of fishing for Salmon is accompanied, are well shewn in the following narrative, which is extracted from an Irish authority, but is not the less authentic on that account:—The River Shannon is known for the large size of the fish which frequent it; and it was one of the largest of these which fought a battle with three fishermen, and after a long contest came off conqueror. With the first of these the contest lasted for five hours, during which he was worked three miles down the stream, until at last in the approaching darkness he became faint with fatigue, and then a companion took his place. The second combatant fared little better; for although he boldly kept up the conflict for eight hours, at the end of that time he found himself seven miles further down the river, with the day just breaking upon him, and with as little chance of a triumph as when he began. A gentleman residing near the river became informed of this extraordinary proceeding, and hastily rising from his bed, he proceeded to the field of fight; where he gave the angler a pound bank-note for the rod and chance of success; and without doubt this was gladly accepted, as well for its own sake as a relief from the fear of discomfiture. By several leaps the fish had shewn itself a worthy prize, and the third combatant entered on the work with spirit. For four miles further, and nine successive hours, the struggle lasted, until at last with a desperate plunge the rod was broken close to the reel, and the whole was carried off into the sea. The time occupied in this struggle was twenty-three hours, and the space travelled over was almost twenty miles. It is known that if a fish in passing up a river becomes wounded or much terrified, it seeks its safety by returning to the sea, from which again it may not speedily come into the same stream.

But the season comes when the Salmon must deposit its spawn, and this is found to be everywhere in the months of winter; for although in a few instances it has been noticed as occurring as early as September, and again as late as March, these are exceptional cases, and the larger number are known to enter on this function from the middle of November to the following January. This is the time when good policy in an especial manner should be directed to the protection of these fish, as much with reference to the interest of the fisherman as of the public; for at the time when companies of these fish have met together in the early part of the year, in the manner we have already described, and to which we shall again refer, for the purpose of passing into fresh water, their association appears to be that which may be denominated colonization, which binds them only to the community, and not to individuals; but towards the close of the year their union is more select and sexual, and, we may add, important; and in forming it it sometimes happens that fierce encounters take place among the males while choosing a partner, in doing which it would appear that a strongly expressed sentiment has had an influence in forming the choice; and in every instance, on the land as in the sea, the rivalry is found among males and not in the females. The anger thus excited has sometimes led to the vengeful destruction of the vanquished, but when the alliance is formed the partners proceed without delay to search out a situation best adapted to the deposit of the precious seed, and the safe rearing of the expected progeny. In such a place the water must flow in a moderate current that is neither shallow nor deep, and it should be as near the fountain-head as is consistent with these conditions, with a bottom of gravel or sand, which must not have been newly laid or lately meddled with. More than one couple may chance to choose the same neighbourhood but they keep apart; and the first portion of the work is to form such a channel as shall be of the depth of a foot or more, but the manner of accomplishing this has been represented differently by different observers. In the "History of the Salmon," by Ephemera, it is affirmed that the snout is made to perform an important part in the operation, by ploughing up the ground in order to its removal; but this is discredited by others, and there is no doubt of the office of the tail, which becomes excoriated by sweeping aside the gravel so that the current may remove it out of the way, and again by covering over the deposit. The course of this channel is made directly against the stream, and the work is not accomplished in one effort, but the grains are shed into it at intervals, so as to require several days, or even a fortnight for the completion, the cause of which is that the whole of the roe is not ripe for expulsion at the same time. The male follows up the work of his mate by shedding on her spawn the fertilizing fluid; and as the parents thus proceed the further progress of excavation is so contrived as to cause the sand to cover in succession the deposited treasure, which readily falls to the bottom. When all is done the surface is made level, so that none but an accustomed eye would be able to discern where it is the fish have been at work.

It may be that the way in which the Salmon deposits its spawn shall vary to some extent according to the situation; but the method pursued in Scandinavia, if correctly described in Mr. Lloyd's adventures in these regions (vol. i,) on the authority of Mr. Alexander Keiller, as he says, after continued observations for five years, is so different from anything that has been recorded in this country, that we can scarcely refer it to the same species. He says that the larger Salmon always appear first in the spring, and as the summer advances the fish are much smaller, but in autumn heavy fish again shew themselves, which, however, he supposes not to be fresh run from the ocean, but that they have remained hitherto in pools low in the river. In the Save they begin to spawn about the first days in November, and so continue through the month. The female deposits her eggs in comparatively still water, shoal, from six to eighteen inches deep, and immediately above a rapid. It is commonly supposed that in conjunction with the male, the female Salmon scrapes a hole or furrow in the bed of the river, in which to deposit her eggs, and that afterwards, and as a protection from their numerous enemies, they cover them over with gravel; but such is not the fact, at least in the Save. The male has nothing to do with this part of the work; and the ova, instead of being dropped into a cavity, are deposited on a comparatively smooth surface. When in the act of spawning the female retains its natural position. Her belly is near the ground, at times, indeed, probably to rest herself, touching it. The process of dropping her eggs appears to be slow. When a few are collected she turns on her side, waves the flat of her tail gently downwards to the roe, but lifts it up again with great force, by which such a vacuum is caused as not only to raise the eggs from the ground, and thus to distribute them in the stream, but to throw up a mass of dirt and stones, the latter not unfrequently of very considerable weight. When the spawning has once commenced it seems that the male can no longer retain his milt, nor the female her roe, the emission continuing under all circumstances. This has been often noticed even long after death. The specific gravity of the roe is but little greater than water. After the female commences spawning he has never but on one occasion seen the male in actual company with her. His station at that time is at the distance of six or seven feet, directly in her wake; and the only apparent part he takes in the generative proceeding is by the deposition of his milt, which of course becomes mixed with the eggs of the female as the stream drifts them past him. Several fishes of other kinds, of which the Trout is the chief, are waiting at a greater distance to seize on the spawn which may drift so far. Other males wait for the same female, but it is the business of the first to drive them away, in doing which furious battles are often the result.

But such as we have already described is the more frequent, as it appears the more natural course of this proceeding, which, however, is often broken in upon by human interference; for while the unsuspecting partners in the toil are earnestly occupied with their work, and their attention is thus diverted from their own safety, some prying bipeds have sought them out with the intention of obtaining all they can lay their hands on of the victims; and that too not only in defiance of the law, but also of what is represented as a kind caution from other fishermen, whose employment has been successfully carried on lower down the river, but has now been compelled to cease for the season. In consideration of the health of those who live near the higher banks of the river, and who might be induced to capture and make a meal of these fish at the time when they are engaged in shedding their spawn, the important fact is widely proclaimed that the Salmon has now become unwholesome; and therefore that these depredators had better abstain from food which may endanger their lives. We must assign the reproachful name of poachers to those destroyers of the fishes at this important season; but these men have feasted on these fish too often to feel an apprehension of danger to their health from the cause assigned; and therefore they have no fear of proceeding to obtain the prize by first alluring them within reach with a burning torch, of course in the hours of darkness, and then piercing the male with a trident spear. The sexes are readily distinguished, even in the water; and when deprived of her mate, the female will go into the deeper pools in search of another, which she obtains by meeting with one not yet engaged; or perhaps by displaying superior attractions she draws away some one that had been already affianced to another. But her second partner shares the fate of the first, and when no other can be obtained, herself becomes the final victim. Unfortunately, however, this is not all, nor even the worst of these injurious proceedings; for somewhat early in the seventeenth century a fisherman of the name of Barker had made a discovery in the art of angling, which he communicated first to a noble patron, and then to the public; and which consists in salting and drying the roe of the Salmon, to be taken at the very time when it is ready to be shed. From experience he pronounces this to be the best bait for Trout he had ever used, and to be good also for several other sorts of river fish. Each female Salmon is supposed to produce four or five pounds of this valued roe, which is made into a paste, and sold at from one to two shillings the pound, and even more; so that the capture of a spawning Salmon is no contemptible affair to a poor man, who may gain more in an hour in this way than by the ordinary work of a week.

But notwithstanding the condemnation which must fall on these proceedings, which go far to destroy the prospects of future seasons, and the wealth of a nation, the complaint comes with a bad grace from those who have contributed to the destruction, by indiscriminately entrapping in the lower districts those fish which might have made their way upward in an earlier season, and thus supplied the wants of the people above, and at the same time filled up the requisite number of breeding fish, and rendered the slaughter of them unnecessary.

Before the comparatively modern inventions which have been stimulated into existence by the demands of fashion and luxury, the Salmon-spear was deemed an honourable weapon, and as such had been taken into their coat of arms by families of distinction; but probably it was then used as affording an evening's party of amusement rather than for mere profit; and in this manner it was practised with less injury to ordinary fishing than even the usual sweep or drag-net. At least we are told that in remote times there were places at which Salmon were so abundant, that it was a matter of covenant between the master and servants that they should not be fed on this fish oftener than three times in a week. Dr. Fuller, who wrote his "Worthies of England," in the reign of Charles the First, mentions this under the section of Herefordshire, but he appears to regard the report as no more than a joke. Such however was not the case, and in a book on the agriculture of Berwick, by Robert Kerr, it is said that "formerly servants stipulated with their masters that they should not be compelled to make frequent meals of Salmon." In the work "Notes and Queries," for May, 1857, there is also a quotation from Coursell's "History of Gloucester," where, speaking of the House of Lepers in that city, he says, "it was a standing condition of apprenticeship that the apprentice should not be obliged to eat Salmon more than thrice a week, the object being to render him less liable to the leprosy, which after the crusades in the middle ages was a formidable disease, that was supposed to be brought on or aggravated by the eating of fish." But if this fact, which affords so strong a contrast to what is known in our day, seems remarkable, it will appear less so when we consider the difficulty which then existed of conveying to a market any large quantity of fish as often as it might be caught; but more especially, that the Salmon which were the subject of this bargain were either pickled or smoked after being salted; and therefore hard, and scarcely to be digested. Such must have been the case where fear could be expressed of their producing such a disease as leprosy; and in this condition the Salmon could not have been a more agreeable food than any other salted fish, and scarcely equal to some of the more common kinds.

But before we quit the subject of illegal or irregular fishing, I will mention another method, which has been practised chiefly, if not solely, in Ireland, and for the knowledge of which I am indebted to an individual who has practised it; and although it may be that I am divulging what might more properly be kept concealed, yet on the other hand the knowledge itself may have a tendency to procure the defeat of a practise which must in a high degree be injurious. The class of persons who in that country are depredators on rivers, are in the habit of rendering the fish stupid, and the Salmon especially, by means of a plant which they gather and bruise by stamping on it near the bank; and thus simply prepared a small basketful is placed in the flowing stream, where it is found sufficient to infect the water and stupify the fish to the extent of several miles. The poisoned fish rise to the surface, and may be taken with the hand; but they are not at all the less fit for food. I learn from Sir W. J. Hooker's "British Flora," vol. i, that this plant is *Euphorbia Hiberna*, which grows to the height of two feet, and produces flowers in June; but those who may wish to prevent injury to rivers from this cause, may easily obtain their object by preventing its growth.

Everywhere the Salmon is a prolific fish, but the quantity of roe is prone to vary according to the age and bulk; and some observers have gone so far as to assign a certain weight of one in proportion to the other; each pound of fish implying a thousand in number of the grains of spawn, a number which probably is much below the mark. Willoughby says that the Salmon requires six years to attain its full growth, and at the River Ribble, which he particularly mentions, the successive yearly stages were so well marked, that at each season it received the separate names of Smelt, (or Smolt,) Sprod, Mort, Forktail, Half-fish, and Salmon; but some supposed that in three years they reached their full extent of size. It is probable they are capable of increase of bulk long after this, although in some rivers more than in others; but in our own country there are few so fortunate as to escape for several years the various snares that are set for them, and from this cause the roe must be proportionally less in quantity than formerly, even from the same number of fish.

In what is properly the natural history of the Salmon, as of two or three others of this family, there are to be noticed some curious variations of instinct and power, by which actions of an opposite kind are brought alternately into exercise. Thus at the earliest stage of its existence it would die if immersed in salt-water, but soon afterwards it is impelled to go to the sea, in which it grows rapidly; but however congenial this may be for a time to its nature, in no long time for the most part it is again impelled to press its course up the stream in spite of hindrances; and yet again a change takes place, and the same individual is equally eager to retrace its course. That there is a necessity for these alterations of action is seen by appearances of the fish which are subject to them; but in their nature they are too obscure to be comprehended by us; although we become aware of the existence of causes which hasten or delay them in the instance of individuals.

It was an early opinion, which is also supported by the authority of Rondeletius, that the spawn of the Salmon was shed and hatched in the sea; but late experiment has proved that the presence of salt-water is fatal to the development into life of the fertilizing property of the milt, as also of the impregnated egg if it come in contact with it. It is also shewn in the "Intellectual Observer," (April, 1864,) by the Rev. M. J. Berkeley, that in a sluggish flow of fresh water or in a tank the grains of roe are exposed to the danger of becoming covered with a parasitic growth of vegetable fibres of several species, which deprive them of the power of further development; and this important observation may assist us in accounting for some of the mishaps which have attended the attempts that have been made to bring to life and educate the young fish which have been taken from their native beds, and placed in tanks or artificial beds. The presence of slime or mud is hurtful to the egg or newly-developed young; and it is the opinion of observers that the grains are injured if they lie in the gravel so near as to touch each other.

But when escaped through these various dangers much difference of opinion has been expressed in reference to the length of time during which the grains may remain buried in the gravel, and consequently how long it is before they manifest the active powers of their existence. Nilsson says that in Sweden this is an hundred and thirty days, and in Scotland it has varied from an hundred to an hundred and forty; but so considerable a difference as this may fairly be judged to be connected with the warmth or coldness of the climate and season; and from this we are at liberty to conclude further, what is also shewn by observation, that in still warmer districts, especially from the south and farthest west of

England, a much shorter time will be sufficient for the purpose. It is known accordingly that the roe of this fish has been developed into life in these last-named districts within the space of sixty days; and in proof of this hastening influence of temperature Dr. Knox procured grains of roe which had lain in the sand for a hundred and sixteen days, but had not yet shown signs of becoming hatched; yet when these were placed in a bottle, with their native water, and brought into a warm room, the actions of life very soon displayed themselves. It is to be observed, however, that when thus hastened on, and the regular course artificially interfered with by a sudden application of heat, or too high a degree of it, the very young fry are much less likely to survive it. Dr. Davy found a temperature above seventy degrees, and up to eighty, to be certainly fatal to the eggs of fishes of this family, as also of some other fishes. In Mr. Shaw's experiments on the breeding of Salmon, when the temperature of the stream he employed was at thirty-nine degrees, and of the main river from which the breeding Salmon were taken thirty-three, with that of the atmosphere thirty-six, the embryo after fifty days was seen to be able to move under its covering; and it escaped from the egg when the temperature was at forty-four: but the whole of this implies a far deeper degree of cold than is the average of rivers at the same season in the south-west of England. Mr. Shaw remarks that the "ova which for a time previous to being hatched had been almost daily in my hands for inspection, did not appear to suffer at all from being handled. When I had occasion to inspect the ovum I placed it in the hollow of my hand, covered with a few drops of water, where it frequently remained a considerable time without suffering any apparent injury." But afterwards he admits that it shewed an increase of activity from the heat of his hand, and the variation of temperature thus produced would probably lead to injurious consequence, although the young at last seemed capable of surviving longer than Dr. Knox supposed. This last-named gentleman found sometimes that they had quitted the gravel by the 1st. of April, but at other times it was not for upwards of a fortnight after this; while on another occasion Sir Francis Mackenzie made the experiment, on the

23rd. of November, of pressing some grains of roe from a female, and milt from a male, which were placed with others that had been deposited voluntarily, and to these more were added at the beginning of December; but although thus shed at different times all of them shewed very visible signs of life at one date—the following 19th. of February. On the corresponding day of March these young fish had increased much in size, the degree in which they had advanced being visible according to the temperature of the weather. On the 22nd. of that month the eyes were plainly to be seen, and for a considerable time afterwards, as in the generality of fishes, they were proportionally of large size. In some of these young the outward covering had burst, leaving the bag which contains the nourishing contents of the egg and abdominal organs still attached to the throat, where it forms the larger portion of the bulk; but as the yoke becomes absorbed these organs also become gathered up closer into the proper cavity, and in the present instance this was accomplished on the 18th. of April, when the fish had grown to three fourths of an inch.

A lengthened account of the development of the embryo is given, among others, by Ephemera; but to be more brief, before the length is attained as we give it, the body is slender, and when not entirely extricated from the egg the tail is bent down into a curve; and afterwards, for a time, what at last becomes the adipose fin, is long and united to the tail, and the latter being joined also to the anal fin the whole resembles much more what is the natural structure of the eel, excluding the rays, than what afterwards is changed into the proper character of the Salmon. At this time also the head is round and blunt, with a depression before the eyes, and the lower jaw is rather the shortest. But changes are in rapid progress, and as the fish becomes able to move about, the growth increases, and there is a display of marks of colour on the sides; which assume the form of bars from the back downward; a condition that is common to several species of this family, and so long as it exists it is exceedingly difficult, if not impossible, to distinguish between them. The existence of these bands on the side has caused the young fish which bear them to be termed Parrs, and it is received as a truth in many places, that all which bear these signs will assuredly at last become Salmon, or some other of the larger species of this family.

We leave the consideration of this question until we come to treat of another species of the same tribe; but in the true Salmon these bands are usually in no long time superseded by a diffusion over the surface of a brilliant silvery tinge, which appears to reside in a new order of scales; and when this takes place a new instinct is manifested, under which fresh water becomes irksome, and even injurious, and these little fishes hasten down to the yet untried waters of the sea; and yet, even at this time there appear to be some materials which are necessary, but not always provided. They loiter in considerable numbers in the pools of rivers where with eagerness for food multitudes are caught by anglers who fish for them with a worm or fly, until at last a welcome fall of rain removes the difficulty; so that where of an evening they have been caught freely, on the following morning, in May, not one is henceforward to be found. It has been noticed that while thus passing downward in fresh water, these young fish prefer to keep near the border; but on coming into the salt they pass into the deeper part, and soon after they disappear from human sight, and go we know not whither. Such as we have here represented has been generally understood to be the natural course of proceeding of the young of the Salmon, from the time of their quitting the egg to their passage into the sea; and such may safely be pronounced the ordinary case in the south and western portion of our island; for none in any stage of growth of the true Salmon can be recognised in the rivers of Cornwall and Devon during the summer, except perhaps that in the Tamar a few examples of full size may appear at that season.

But since the practice has been adopted of breeding the young Salmon in ponds prepared for the purpose, it has been observed that while a portion of the young fish have passed through the changes we have described in the course of a single season of spring, there are others which have undergone them so slowly as to have remained in what is termed the Parr state for a whole year, or even for two or three before they have attained that condition which prompts them to migrate to the sea; and even further than this, that in their diminutive, although it cannot be said their very young condition, they are said to have aspired to pair with a full-grown female for the continuance of the race; a Parr of five or six inches in length producing so much of the milt as will render fertile a quantity of roe that is more than equal to the bulk of its own body. It is known indeed, or believed, that some of these Salmon Parrs, at least in the north, will remain in fresh water through the summer, while others of the same brood have emigrated; but the causes of this are still undetermined. It is, however, an established fact that when confined within a narrow range, the growth of fishes generally will be stinted to the dimensions of their dwellings; and it is further certain that every unnatural condition has an influence on their development, and perhaps more especially on those of the Salmon family; which circumstance may go far to account for some remarkable changes of structure and deficiencies that we shall have to point out in the history of the Trout.

We hesitate, therefore, at present to adopt the conclusions which appear to prevail on this subject, as if they were of universal application; and we may be excused the rather for these doubts, since some attentive observers of the experiments on which these conclusions have been built, have shewn a remarkable aptitude in changing their opinions on apparently insufficient grounds, and several of the experiments which have been prominently put forward are pronounced by others as eminently mistaken or inconclusive.

As illustrative of these remarks, some young Salmon were kept in a fresh-water lake in Norway for five years, and so much was their growth stunted by this confinement, that at the end of that time each one weighed only one pound and three quarters. Placed in a large lake after a few years some of them grew to weigh three pounds and a half, and others five pounds. Sea Trout similarly kept were of still slower growth. Mr. Brown, to whom reference will again be made, makes some mention of a young Salmon which remained in the fishpond for five years, of which three had passed before it had acquired the shining scales; but he does not assign any cause for this delay, nor does there any appear in the case of a Trout, presently to be mentioned, except the single fact of confinement within a very limited space.

It is curious that the habits of the Salmon while at sea are scarcely at all known, nor the extent of its wanderings; so that however numerous if this fish were not accustomed to search out our rivers, we should scarcely be aware of its existence. In the course of many years I have only been informed of a very few instances of the taking of Salmon with a bait in the open sea, and those not many miles from land; in a single instance also I was a witness to the finding of the posterior half of this fish in the stomach of a Skate caught at a considerable distance. But as the Skate does not bite its prey, so as to separate it into portions, my conclusion was that a Shark had first bitten all it could grasp, and the remainder had fallen within reach of the Skate. Beyond these instances I know not of any record of the existence of the Salmon in the deeper water of the ocean, although its haunts must be there when out of sight. Nor do we possess much better evidence of the nature of its food while in the sea, until it approaches within a small distance of the shore; although from its plump and healthy appearance, joined, when in an early stage of its existence, to its rapid growth, this must be procured in abundance; and the armature of the mouth sufficiently shews that it is fitted to seize something of a substantial nature. Dr. Knox has expressed his belief that this food consists principally of the eggs of star-fishes, and others of the class *Echinodermata;* but the quantity of this must be too small and precarious for the sustenance of thousands of these fish. Their stomach is often found entirely empty, but young Herrings and Launces have been discovered in it, and the latter in sufficient abundance to shew that it forms a favourite diet. Sir William Jardine says there is no better bait for an old Salmon than a young Samlet; and it would be amusing to suppose that after the Parr had served the purpose of a husband, the next step would be for him to form a meal for his hungry partner.

But it is to Dr. Cobbold, F.L.S., we owe (in the Journal of the Linnæan Society, vol. vii,) a more particular account of the contents of the stomach and bowels of the Salmon, although indeed these remarks were made on it when taken in fresh water. He says, that in its usual condition the stomach is coated internally with a consistent white mucus of great tenacity. In ten instances only, from February to September, did remnants of fishes occur, and in all these nothing remained but vertebral columns, cranial and other bones, with the denser tissues, as the lens, etc. The number of bones in several cases shewed that these fishes had enjoyed a most ample repast, since they belonged to species from eight to ten inches in length. Some pieces of cartilage, skin, and pigment cells seemed to belong to Smelts, but most of the vertebræ belonged to larger fishes. The other kinds of food found in the stomach consisted of fragments of small fresh-water crustacea, with a portion of a Shrimp in one or two of these fishes; and an occasional piece of insect cuticle. Accompanying a quantity of mucus, which is found in the intestines, is a number of white or yellowish masses, which are gritty, and consist of calcareous crystals; of which the origin is an interesting question, but it is not influenced by the kind of food. The skeleton of the Salmon being of small specific gravity, and deficient in earthy matter, it may be that the excessive elimination of salts keeps down the specific gravity; or the circulating fluid by this means may so adapt the bones to the varying density of the salt and fresh water, that their specific gravity is in accordance with the medium in which they swim. The rapidity and power of digestion in this fish are extraordinary; and the true state of the matter seems to be, that the Salmon when in fresh water feeds rarely and at intervals, but not from want of voracity. There is abundance of parasitic animals in the entrails of this fish. I was informed by Mr. Bewick, the eminent engraver on wood, that when a gentleman of Newcastle had lost a gold ring from a boat on the Tyne, he was so fortunate as to recover it from the stomach of a Salmon which was purchased in the market at Newcastle. But whatever be its food, it is noticed that this fish soon declines in growth and the quality of its flesh in fresh water; but it is then successfully fished for with large artificial flies, which must be of gorgeous and glaring colours; and these beyond doubt are viewed by the fish as native inhabitants of the stream rather than of the air, as is proved by the manner in which it is necessary to employ them; which is by causing them to sink below the surface, and there kept in motion unlike that by which the Trout is enticed to leap after a fly.

It has been questioned how soon it is after going down to the sea, before the young of the first season, or of the second if they have remained so long in fresh water, are induced to ascend again into the river; and there appears reason for supposing that they differ in this respect according to the state of the weather, especially its tendency to wet; the particular habit of the variety of each district, whether early or late; but more particularly according to the bulk or stoutness they have acquired; which latter particular so operates on their condition and feelings, as to urge them on to the fresh water as a relief; while those which are not so well fed are disposed to remain longer where they are.

But that some of these young ones which left their native stream when only four or five inches in length, with a weight not exceeding an ounce and a half, have returned soon with an almost incredible advance in size has been proved by manifold observation. Mr. Brown, in his account of the experiments at the ponds at Stormontfield, informs us that a young Salmon carefully marked, which weighed a little less than two ounces, went down to the sea on the 24th. of May, and was taken on its return on the 7th. of July, when its weight was three pounds; and another of the same brood that was caught July the 31st., weighed nine pounds and a half. According to some experiments by Daniel Ellis, Esq., reported in Jameson's "Philosophical Journal" for 1828, some young fish were carefully marked in April, as they were passing downward, and five months afterward, when they returned, the weight of each was eight pounds. And although the growth is less rapid after this time, it was shewn that in thirty-three months of their life the advance had been nearly at the rate of one pound and an ounce for each month. In the "Zoologist" we have an account of some which were hatched from the egg in sixty days, and going down the river in May, when some of them weighed an ounce, and others only half that weight; after two months one of them that had been carefully marked measured twenty-four inches in length, with a weight of five pounds and a half; and others were of the weight of eight pounds.

Amidst a sufficiency of other evidence to the same purpose, we add only that of Sir William Jardine, whose authority on this subject is beyond dispute. He says it has always been a subject of doubt whether the fry returned to the same river as Grilse in the same season in which they descended. "I have had no doubt of this for several years, but it was very difficult to prove. In the Tweed I have killed Grilse early in the season so small as only to weigh two pounds, and seen them gradually increase in size as the season advanced; the intermediate size, however, between the fry and the two-pound Grilse was wanting. During the two years in which the fisheries of Sutherland have been in the possession of the Duke, a set of experiments have been instituted by his factors, one of which leaves no doubt upon the subject. Last spring several thousands of fry were marked in the different rivers, among others in the Laxford and Dinard, on the west coast. In the Laxford the first Grilse (marked in April as fry) returned on the 25th. of June, and weighed three pounds and a half. Many others were got during the season from this weight to six pounds and a half, returning to the river where they were marked, which was known by a particular mark being used in each, and shewing that a return to their breeding-ground was as frequent, or rather as constant as among the higher animals. The size and weight exactly agree with that of the Grilse upon their first running elsewhere, and I think that very few attempt to enter the rivers before attaining the weight of three pounds."

But all the fish which have gone down to the sea are not found to return in a proportionate time; and in the north at least a succession of them continues through the greater part of the summer, with an increase of size in the new comers; so that by the months of August and September, they are often found to be nearly twice as large as those of the early months. Some of these, while continuing in the condition of Grilse, have been known to attain the weight of fourteen pounds; but perhaps the most remarkable instance of rapidity of growth on record is given on the authority of the Duke of Athol, (which we copy from the "Quarterly Review," April, 1863.) The fish marked was first caught as a Grilse at forty miles from the sea on the 31st. of March; at which time it weighed exactly ten pounds. It went down to the sea, and returned again in the short space of thirty-seven days, when it was again caught; and being carefully weighed, the weight was found to be twenty-one pounds and a quarter. It has been repeatedly proved by marking the fish, that when a Grilse had gone down to the sea, it always returns with all the characters of a Salmon. It is also an acknowledged fact that the fish of any age which have gone down to the sea will, unless under very extraordinary circumstances, return to the river of their birth; while the guiding influence in doing this is beyond our powers to comprehend. But in the work by Ephemera, already referred to, we find an instance of this, which illustrates this habit in a manner beyond what we could have supposed:—

Loch Shin is a large piece of water in Sutherland, from which proceeds the River Shin, "noted for its Salmon fecundity." The loch itself is supplied with water from four rivers of moderate size, but in which, before the year 1836, "not a Salmon was ever seen, though many were in the habit of entering the loch." But in the year now mentioned, Salmon were caught in the River Shin shortly before the breeding-season, and conveyed to the four rivers above; in each of which some of them spawned, and from that time each of those rivers is furnished with fish, and each of them with its own, which pass by and beyond the stations which their ancestors frequented to enter the higher rivers, of which they are now the natives. The fish which thus pass up the stream from the sea are readily distinguished from such as have been long in fresh water by their brilliant colour, which in no long time subsides into a darker hue; but although the growth appears to be presently arrested, it is without decrease of strength or activity; for it is in the experience of anglers that a Grilse which has been longer in the river will put his tackle to a more severe trial than a Salmon of larger size that has only lately arrived. It has further been noticed of late that there are Salmon and Grilse which do not quit the sea through the summer, although others of probably the same brood press towards the fresh water; and further, that there is no small number which do not seek to breed when others of the same age are performing that function; and why this is so we scarcely venture to guess; but these circumstances tend to explain how it happens that there are fish in high condition in many rivers, and in some much more than others, at times when the generality are far otherwise. The natural history of many rivers is closely connected with this, and the interests of fishermen greatly so; but it is probable that a really barren Salmon, except of unnatural formation, does not exist; as also it seems certain that there are some in which the procreative impulse only revives with intervals of a year or two, and in some instances at an unusual season of the year. Fulness of habit or plumpness, or repletion, has certainly an important bearing on the spring and summer tendency to emigration, independent of the merely sexual impulse; and it is one effect of fresh water that the excess is soon abated, even when that water is of the purest kind; but when soiled with what flows from mines of copper and lead, it is so offensive not to say fatal, that these fish soon learn to seek safety in other haunts. Such is the case when the stream is polluted with what flows from some manufactories; and it was shewn by evidence before a Committee of Parliament, that where a river has become foul from tar or coal-gas, the flesh of a Salmon caught in it has become so infected—although the fish itself did not appear to be out of health—that even the smell from it was offensive at the table.

An interesting portion of the history of the Salmon is connected with the attempts which have been made to propagate it by artificial means; which consist in obtaining the roe from beds in the river in which it had been shed spontaneously; or by pressing from the living fish the roe and milt, and placing them in pools of running water prepared for the purpose. They become developed, and the young are fed with prepared food, chiefly animal liver reduced to pulp, until they are ready to emigrate to the sea. It is by these means that several rivers which had been overfished and obstructed, and thus robbed of their native inhabitants, have recovered what they had lost; and in pursuit of what we must thus denominate an experiment, a considerable amount of knowledge has been thus acquired of the nature of the Salmon, where we were before altogether ignorant The practice began in France by the ingenuity of two humble fishermen, named Gehin and Remy, of an obscure village called La Bresse in the Department of Vosges, and they first applied it to the propagation of Trout. The subject was presently taken up by the Government of that country; but it was made known among ourselves by one who wrote under the name of Piscarius; since which it has been adopted among us with success. Much effort has also been exerted to convey the Salmon to the British Colonies, in the southern hemisphere, and especially to Tasmania; whither the eggs have been conveyed, enclosed in ice, and with so much success as is implied in that they have been hatched into activity; but with what further result as yet remains uncertain.

We feel no surprise in being informed that the Salmon frequents the rivers of Kamtschatka; but it is also said to be common, and even in abundance in the Caspian Sea; if it be indeed the same species with our own. It is in season there in May, and in Mr. Frazer's Travels we are told that it is rarely caught east of Resht in that sea, but it is well known on the west and north-west shores.

The value set on the Salmon in this country, whether fresh or in salt, has always been considerable, although Polydore Virgil does not name it among our articles of trade; but we find it so from several incidents, and the strictness of the laws concerning it at an early date. Thus, in the fourteenth century, and perhaps long before, we are told in the life of the famous Thomas à Kempis, as written by his friend Franciscus Tolensis, that the love of that pious writer for the Book of Psalms was compared by his brother monks to their love for Salmon; for, adds the biographer, it is an exceedingly delicious fish; and that in some places it was scarce and bore a high price was a subject of complaint in the fiftieth year of Edward the Third, appears from a petition then presented to the Crown, in which it was prayed that whereas the Salmon and other fish in the Thames were taken and destroyed by engines placed to catch the fry; which fry was then used for feeding pigs, a law might be passed to take up all the trunks (tous les trynks) between London and the sea, and forbid them for time to come; also that no Salmon be taken between Gravesend and Henley Bridge in winter; that is to say, between the Feast of the Finding of the Cross and the Epiphany; and that the river guardians suffer no net but of large mesh. The petition (which is in French) concludes thus—"awaiting which, most redoubtable Lord, if it shall please Your Highness thus to make order for the next three years, all your people repairing to London or bordering the river, shall buy as good a Salmon for two shillings as they now get for ten." (Notes and Queries, 1855.)

But it appears there was an omission in the recommendations of this petition, or the crime may not have begun to operate at this time; for we are informed in Moule's "Heraldry of Fish," that in remote times an offering of fish had been, and that for several centuries, claimed and allowed to the Abbot of St. Peters in Westminster, on the plea that when Saint Peter, according to the legend, had come and consecrated that church, he made a grant to the convent of the tithe of all the Salmon caught in the Thames, to the same extent as the present jurisdiction of the Lord Mayor; which is from Yantlett creek to the bridge at Staines; and among the many causes that have been assigned for the scarcity of Salmon in the Thames in more modern times, not the least of them was believed to be, that the fishermen had left off making this accustomed offering. A cause not altogether unlike the above has also been assigned by Dr. Boate, in his "Natural History of Ireland," for the diminished quantity of Salmon in that country. He says that before the Revolution in the year 1688, this fish was plentiful and cheap; but since that event, to which this author ascribes all the natural calamities of his country, gentlemen have complained that Salmon had become scarce and dear; but he does not add that the fishermen complained of not obtaining greater success or better remuneration.

That in the reign of Elizabeth a Salmon at table was accounted a matter of fashion, in which a person of ordinary rank might be tempted to ape the rich and the great, appears from a scene in the tragedy of "Othello," although it seems incongruous to place the reference in the mouth of one to whom the fish could scarcely have been known; but it is represented as an instance of good sense in a woman, that in her wisdom she was never so frail as to change the more useful although homely Cod's head at her table for the tail of the fashionable Salmon. But the price of Salmon rose gradually in different parts of the kingdom, and with it the rents of the larger fisheries in the north of England and Scotland, until the latter have amounted to a princely income. So long since as about the year 1730, I find in a MS. Journal that in the market at Plymouth two pounds of Salmon and fifty shrimps (prawns) were purchased at the cost of six shillings; but as a contrast to this, I find in the same Journal, with the date of 1761, "The Saltash fishermen, with two nets, catch'd eighty-five Salmon over against Warren Point; forty-five in one net and forty in the other; they may not have such another draught for the whole summer. For two of these

Salmons, at twopence per pound, one for the servants, as being cheaper than meat, 4*s.* 9*d.*" A common price at present is from two shillings up to four shillings the pound. The highest price on record is that of a Salmon which weighed nineteen pounds, and which, in February, 1809, was sold for a guinea the pound; a freak of ostentation that was rather caused by a craving to be talked of than to satisfy the appetite.

As a subject of curiosity we will only glance at the laws which at a distant date were made to regulate the trade in Salmon when brought from out of the kingdom, of course in a pickled or salted state. In the year 1423, the second of Henry the Sixth, it is ordered that "the buttes of Samon comyng be wey of merchandise into this land out of straunge countrees, and also in this land ymade, shulden be of certein mesure;" and that among the strange countries Scotland had long held a principal place appears from an Act of Parliament of the thirty-first of Edward the Third, (1357,) where the fish brought from thence are termed Salmon of Berwick, the conveyance from which place to London at that time could not have been effected with fish in a fresh condition. It appears further, from an Act of the twenty-second of Edward the Fourth, (1482,) in which the right of fishing in the Tweed is let on farm to the merchants and freemen of Berwick, with a monopoly of the Salmon, that the packing of Salmon in barrels was further regulated by the same Edward, and also by Henry the Eighth, by whom the monopoly was continued; so that Camden was warranted in saying that in ancient times Salmon were the chief commodity of Scotland.

The principal cause which reduced this trade to insignificance was the contrivance by Mr. George Dempster of packing the fresh fish in ice, by which means, and the aid of the railroad, instead of a sailing vessel they are now sent to the metropolis only a little less firm and fresh than when they were caught. The fisheries of Ireland are at present in a prosperous condition, of which we take the example of the River Foyle, from which were sent away in one year of not extraordinary abundance eighty thousand Salmon. In May of the year 1831, there reached Billingsgate, from the River Spey, in Scotland, seventy boxes of iced fish, of which thirty were (Salmon) Trout, the *take* of three days only, and these were sold for one hundred and forty pounds. Mr. Mayhew ("London Labour," etc.) says, that the quantity of Salmon and Salmon Trout sold at Billingsgate in one year was twenty-nine thousand boxes, with fourteen fish in each box, making four hundred and six thousand fish in all, of the weight of three millions four hundred and eighty thousand pounds. There is little doubt that many of these Trout were sold as Salmon, since so different a fish as the Coalfish has been so sold to an ignorant purchaser.

The Salmon was not known to the Greeks in ancient times, and is scarcely recognised by Roman writers, by whom generally it appears to have been held in little value, even at a time when luxury reigned to the utmost among them. Pliny mentions it (B. 9, C. 32,) but only as being much esteemed by the people of Aquitania, in Gaul; and yet many of his countrymen must have been long acquainted with it in the rivers of Britain, where they had been peaceably settled from a distant date. Ausonius is the only other Roman writer who mentions the Salmon, which he does in his characteristic poem on the River Moselle, and from whom we learn that the people there were aware of the distinctions which separate some species of the same family, and especially between the *Salmo* and one which he terms *Salar,* although modern writers have chosen to consider the names at least as applied to the same fish. The Ancient British name is given in a MS. in the Cotton Library as Ehoe, as also by Pryce in Cornwall, and by Pennant, on the authority of Richard Morris, Esq., Gleisiedyn, Eog and Maran; but although not British, the modern designation is not derived from a Greek or Roman root, and will rather be found in the name of the River Salmona, which passes into the Moselle, where this fish was found in abundance, and from whence perhaps the name was brought into our country by men who had been acquainted with the Salmon in both these regions. That the species was the same appears from the lines of the poet, a portion of which has been already quoted:—

> Nec te puniceo rutilantem viscere Salmo.
> Fish of the bright red flesh, the Salmon called.

The Salar is sufficiently distinguished by being named separately,

> Purpureisque Salar stellatus tergore guttes.
>
> With purple spots his back is sprinkled o'er
> In Starlike forms.

There is little added to this meagre account by Sidonius when he terms these fishes "rapacissimæ Salares"—the very ravenous Salars; but naturalists are in error, although our illustrious and generally accurate countryman Ray is of the number, (in his "Dictionarium Trilingue,") when they judge the Salar to be the Common Trout. This last is distinguished by Ausonius under the name of Fario:—

> Ambiguus,
> Amborum medio, Fario intercepte subævo.
>
> Fario, a doubtful kind,
> Between the two, as stopped in middle age.

It is probable that either the Sea Trout or the Peal is the Salar of the poet, and we know that the word Fario is derived from a source which is neither Latin nor Greek; but it is the name of the Trout to the present day, and probably was the provincial name of the same fish in the country of Ausonius. When he calls it ambiguous, it should not be understood as of a more doubtful species than the others, but as forming a natural link of affinity between them: on which subject the ancients held opinions long since given over to oblivion; for it was commonly believed that in all cases where creatures of apparently similar races bore some near resemblance, their likeness was produced by a mingling of the breeds, a kind of natural selection, the supposition of which is of no modern date. We believe that a figure of the Salmon will be found stamped on some Samian or ancient Roman pottery, as represented in the "Intellectual Observer" for November, 1864, where even the young is shewn with the bag of the egg attached to the throat; no small proof that there were some in remote times who studied these things.

The weight of the Salmon was formerly much greater with us than we are likely to see it again, at least while means are so industriously employed to take it in its early growth. The average weight appears to have been about forty pounds, and the largest known to Nilsson was forty-four pounds, with a length of four feet two inches; and this fish was sufficiently old to have lost all the teeth in the vomer, except those in the front. But heavier examples are on record in Britain:—in February, 1826, a Salmon caught in the Tweed weighed fifty-eight pounds; its length four feet, the girth two feet four inches and a half; other examples have weighed sixty, seventy, seventy-four, and eighty, the latter mentioned by Mr. Lloyd; and the largest of all, given by Mr. Yarrell, eighty-three pounds. The general shape is moderately lengthened and compressed, but plump; head comparatively small, more slender in front, the gape large; in the male the point of the lower jaw is bent upward, and particularly so at the season of spawning; a cavity in front of the upper jaw to receive it. Teeth in the upper jaw strong, separate, with a vacancy in front; in the lower jaw thicker; teeth also along the border of the mystache; on the tongue in two lengthened rows, strong, hooked; also round the palate and along the middle, (vomer,) but these latter appear to become less in number, or altogether lost in age. Eye small, low down, near the angle of the mouth; nostrils at one third of the distance from eye to snout. Body covered with scales of moderate size; lateral line straight. First dorsal fin about the middle of the body, fleshy at the base, the adipose fin begins opposite the middle of the anal; pectorals round, first of the ventrals opposite the middle of the first dorsal; tail broad, and its border a little waved. The colour varies with the season, but tends to a steel blue; upper fins the colour of the back, lower fins pale; belly white, a few scattered spots sometimes on the body; the colour less brilliant soon after leaving the sea, and the skin more slimy. Near the time of spawning the sides have a tinge of pink, and the cheeks are often streaked with yellow and faint red. In the dorsal fin thirteen or fourteen rays, the pectoral fourteen, ventral nine, anal eleven, caudal nineteen.

The exact proportions of the body differ not a little in fish of different rivers, and also according to the sex. To examine this more closely, Nilsson obtained at one time a male and female of the same size; and he found the head of the former to be four and seven tenths of the length of the body, which measured forty-seven inches from the snout to the border of the tail; from the snout to the beginning of the dorsal fin the same as from the ending of that fin to the border of the scales at the root of the tail; and from the commencement of the dorsal to the adipose fin the space is double that from the adipose fin to the border of these scales; the adipose fin is over the anterior edge of the anal. The operculum and sub-operculum taken together form a circle. Number of scales from the dorsal fin to the lateral line twenty-five; from thence to the ventrals twenty-two; and in a row between the adipose fin and lateral line twelve to fourteen. In the female fish the number of scales was less than in the male, although the body is higher; the head occupied five parts and one third of the length of the body. Artedi counted fifty-six vertebræ, but Mr. Yarrell more than once counted sixty. The colour of the flesh is found to be caused by the presence of a peculiar oil.

PEAL.

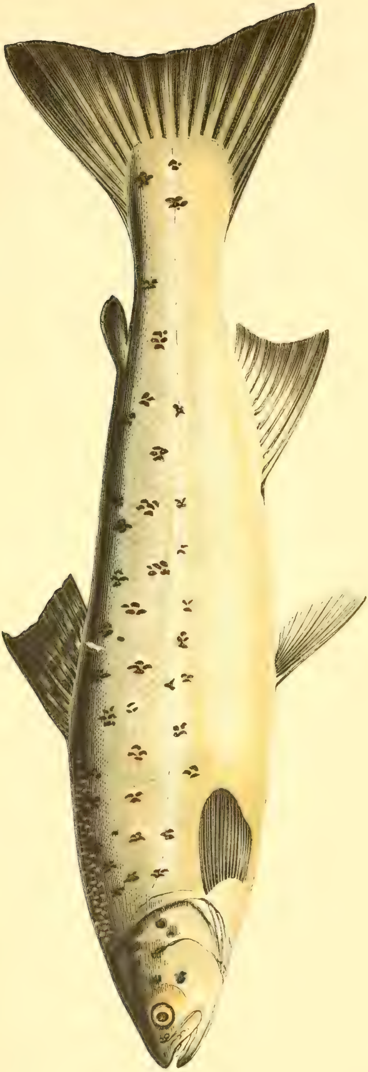
SALMON PEAL. BULL TROUT?

This fish is to be distinguished from one that is called the Salmon Peal in the fish shops of London; which is an early stage of the Salmon.

Salmo Trutta,	LINNÆUS. FLEMING; Br. Animals, p. 180.
The Scurf, Bull Trout,	
Trutta Salmonata,	WILLOUGHBY; p. 193. JENYNS; Manual, p. 423.
Salmo Trutta,	YARRELL; Br. Fishes, vol. ii, p. 77.

The Peal in its habits bears much likeness to the Salmon, as it does also in no small degree in form; but with this there exists also so much contrariety, that it has been observed where one abounds the other becomes scarce; and if from any cause, except indeed from that which is too common in some parts of England, the presence of mineral water, or the refuse of poisonous manufactures in the river, the Salmon is driven to forsake it, this fish presently resorts to it in increasing numbers; but they for the most part quit it again if Salmon again become abundant.

When speaking of the Salmon it was remarked that the place of resort of this tribe of fishes when at sea is scarcely known; but less uncertainty exists as regards the wanderings of the Peal, since so early in the spring as March or April, and still more frequently in May it is often caught, but usually as single individuals, in the drift-nets shot for Mackarel at about the middle of the entrance of the British Channel; where it is in the course of migration towards the land, and nearer to which it approaches as the season advances. As these nets are made to float at but a small depth where the water is



above fifty fathoms, we conclude that this fish swims near the surface on such occasions; as it does also in summer near the land, when drawing near the accustomed river; in which situation it is fished for with a moored and floating net. Not unfrequently also it takes a bait far out at sea, when the line is kept in motion, as in whiffing for Pollacks; and it even seems to be then eager for prey, which the Sea Trout never is, and the Salmon rarely.

An example caught at a considerable distance from land in the same net with Mackarel, had its stomach filled with very small fishes, on which also the latter had been gorging themselves. There is reason to believe, however, that in the Peal, as in most of the Salmon tribe, digestion is quickly performed, so that the stomach is usually found empty. When this fish has reached the coast it soon passes into the river, and in some cases they enter in considerable numbers, bearing with them the same kind of parasitic animal as the Salmon, but which soon quits its hold as in that fish. The rivers where they prefer to resort are often such as from their limited depth the Salmon may hesitate to enter, but so far as observation extends, a strong enticement seems to be that the entrance is floored with gravel or sand. It also appears that they will readily spring above a moderate fall of water, but of course with inferior powers to the lordly Salmon; and the inducement for thus seeking the flowing stream is probably the same as that which influences that fish; which we suppose to be the state of obesity or fulness that has been produced by an abundant supply of nourishing food. But the larger proportion do not continue in fresh water longer than about the middle of August, although in a few instances they have remained to September; and during this time they may be fished for with a worm or fly; but they are more usually sought after with a draw-net.

It is among the most remarkable circumstances connected with the history of this family of fishes, that among some of the species the proportion of the sexes varies in a very great degree; and we find this noticed so long ago as in the time of Willoughby and Ray, by whom it is said that the Branlins, or Fingerlins, are all of them males; and Mr. Dillwyn, in his work on the Fauna of Swansea, observes that "Mr. Talbot has found in his streams at Margain that the Bull Trout are always male and the Sewin female, from which he has concluded that there is no more than a sexual difference between them." But, (setting aside for the present this last surmise, and the further question about the Branlin, whether it be what is now termed the Salmon Parr, or the Parr of the Sea Trout, or, again, the Samlet, of which it would be still surprising if none but males are to be met with, in the numerous examples of the Peal which I have obtained in a long succession of years, as well from far off in the ocean as the river,) I have not been able to ascertain the existence of a single male, and that, too, although the search has been made under favourable circumstances, and with the offer of a considerable reward to a professional fisherman who possessed an exclusive right to a fishery where these fish were taken in abundance in their season. But an accidental circumstance has removed my doubts as regards the sexes of this fish. There was a pool in the western branch of the Looe River, close below the head of an ancient weir, above the barrier of which these fish were not able at this time to throw themselves; and at this place on the 22nd. of January, when the cold was severe, a considerable number of Peal were discovered as they were engaged in stirring up the gravel with the evident purpose of shedding their spawn, and that, too, without there being a single Salmon in the river. The whole, or greater part of these were caught with a net, and then the roe was found to be running from some of them, and ready to be shed in all. Myself examined ten of them, and the remainder, amounting to twenty in all, were examined by others. They varied something in colour from their ordinary appearance in summer, being a little darker, and a few were almost bronzed at the sides; but all were females, and there was only one male found among them, which, however, had its tail excoriated, like that part in the females, as having been engaged in the same work of stirring the gravel for the reception of the spawn. This male fish, which from its associations I cannot but conclude to be the true male of the Peal, was yet sufficiently distinct to warrant a distinct description. It was called by the fishermen a Bull Trout, and had its under jaw hooked, as in the male Salmon, the head more clumsy than in the Peal, the spots large, round, not cruciform, reddish. A remarkable difference was in the adipose fin, which in the female Peal is less, and not so far back. In this male it reached to near the base of the tail. It is worthy of notice that Sir Humphrey Davy, in his "Salmonia," records something not unlike this, but in the opposite direction. In the month of October he obtained a considerable number of Sea Trouts, and all of them were males; but this may have been only a separation of the sexes in the course of migration, as was the case with a goodly number of Charr, kindly sent to me from Ireland by the Earl of Enniskillen, to whom I have been indebted for much assistance in the course of this work, and all of them were found to be males, as were an equal number caught at the same time and sent to the British Museum.

I have not been able to obtain satisfactory information concerning the early stages of development of the Peal, nor of the descent of the young to the sea; but there is a fish, well known in some streams in the west, by the name of the White Trout, and of which I have no doubt of its being an early growth of the Peal; in which opinion I am confirmed by the authority of Sir William Jardine, whose acquaintance with the fishes of the Salmon tribe is generally acknowledged. But there can be no doubt that when this smaller fish shews itself it is not earlier than about the end of its first year; and what forms a singular portion of its history, it is regularly found in some, perhaps small, numbers, in rivers where the full-grown Peal, its supposed parent, is not known to enter or breed. If even we may suppose that some examples of the adult fish have entered their own river and shed their spawn considerably earlier than the time when we have traced them to do so, for irregularity in this respect is not uncommon in all sorts of fishes, it can scarcely be believed even that the progress of the young can have so greatly outstripped that of the young Salmon, as to have reached the length of from four to six inches in the month of January, as I have known these to have done; although more frequently they begin to be caught in March, and from thence onward to May, in company with the Trout. After the last-named month they are found to have left the fresh water, and as we may judge, to seek a change of food in the depths of the sea, from which just at this time the full-grown fish are rising to proceed in the contrary direction. That these White Trout are not the same with those which bear the same name in Scottish rivers—the *Salmo albus* of naturalists—is certain; and in only one instance, where the example was of unusual size, have I ever seen a few grains of roe in them. The usual length is about six inches, the form closely like that of the Peal, and they are easily distinguished by the brilliant whiteness of the scales; on the back a slight tint of blue or green, with faint dots in some instances, and occasionally a tinge of pink on the adipose fin.

It may be useful to be aware that the Peal is able to live in the confinement of a pond of fresh water. Four of these fish were taken in a river with a net, and presently conveyed to a newly-enclosed piece of water of no large dimensions; and after thirteen months they had not altered in any particular.

The Peal under several names is known in considerable abundance through the whole extent of the British Islands, although perhaps with some variation of form and colour, as is the case with the Salmon and others of this family; but there appears much difficulty in assigning to this, and indeed most of the other species, the names given by the writers of the continent; the reason of which we suppose to be, that there exist several kinds of the *Salmonidæ* which are not yet clearly defined; so that not a few which have hitherto been judged to be only varieties will at last be discovered to be distinct species.

From communications received from several districts in the north of our island we have reason to believe that this, under a variety of names, is as widely distributed as any of the same family. An example has been obtained from Robert Embleton, Esq., of Chathill, in Northumberland, under the name of Hirling, (*Salmo albellus*,) which measured eleven inches in length, and closely resembled the Peal of Cornwall; and I owe to the same gentleman, among other valuable communications, the substance of a paper by Sir William Jardine, Bart., which is contained in an early number of "The Proceedings of the Berwickshire Naturalists' Club." This gentleman says, "This fish I consider to be the *S. albus* of Fleming, the Herling or Hirling of the Scotch side of the Solway Firth, the Whiting of the English side, and by which name it is also known in the Eden and the Esk, the Phinnock of the north and west of Scotland, the White or Phinnock of Pennant, and the Silver White of Tweed tacksmen. In the Solway Firth they commence their approach to the mouths of the rivers about the middle and towards the end of June, if the season has been remarkably dry, and perhaps a few days earlier if there has been much rain. From this time they continue running till about the end of August, when the greater part of the shoal is either past or taken. The height of the run, however, may be said to be about the last weeks of July, and their numbers at this time are almost incredible. In the rivers they are caught with the common sweep-nets, in the Firth by the stake-nets of small mesh, or as they are called, Herling houses. Many hundreds are taken at once in each inclosure at every tide, and the whole neighbourhood is for a short time supplied with them. This abundance, with little exception, seems general wherever they are found.

They enter the fresh waters for the great business of spawning, and I have observed that in the larger rivers the great body of the shoal leave the main stream and seek the smaller tributaries, and very few remain where the water continues strong and heavy. The spawning commences earlier than that of the Salmon," (which my own observation has already shewn not to be the case in Cornwall,) "is of course sooner finished, and by the end of February almost the whole of the old fish have returned to the sea. The young I have never been able to see; it is probable, however, they are hatched earlier, and make their way to the salt water when of small size; and three or four months is a sufficient interval for them to have obtained the size and weight of their first appearance in the following June. It may be noticed as remarkable in the history of this fish, and at variance with the habits of the other British Salmons, that from the return of the old fish, or Kelts, to the sea, not an individual is seen till the appearance of the great shoal; a few days before, as stragglers appear, and they are the signal of preparations being commenced for their destruction; but in the intervening four months, between March and the end of June, they are never to be met with;" a circumstance better explained by the

Cornish fishermen. "In this respect," says this learned naturalist, "they more resemble the Coregoni, which are completely gregarious, and also the Herring, to which I believe the above-mentioned genus leads. The fish in the Solway very seldom reach two pounds in weight upon their first arrival; half a pound and three quarters is a common size; afterwards the greater proportion average from one pound to a pound and a half. One of the most marked appearances of this fish is the great proportional breadth of the back, and the peculiar greyish green of the upper parts. This colour appears very conspicuous when seen before the water has completely ebbed from the stake-nets, when the fish swim near the surface, and when small Sea Trout are mixed with them the contrast is at once perceived. The distribution of this fish in Scotland, as far as it can be with certainty traced, is pretty extensive; the south and west coasts, however, seem to possess the greatest abundance. Commencing at the Solway we meet it in great abundance as far as the Dee at Kirkcudbright, from thence we lose it at Loch Awe, at Loch Etian in Argyleshire, from thence it is common along the whole of the west coast;" but beyond this the Baronet appears uncertain of its existence.

A usual length of the Peal is about fourteen inches; the general proportions much like those of the Salmon, but the head is stouter, and consequently the snout is not so slender; the eyes also proportionally larger; the nostrils a little above a line drawn from the eye to the snout, while those of the Salmon are more directly on that line; the gape less wide; sharp teeth in the jaws; mystache round the palate and along the vomer; in the latter a double row, alternate, and complete, while in the Salmon of moderate age they are often wholly or partly deficient. Teeth in the tongue strong and hooked, but commonly not in opposite pairs. Lateral line straight, with one hundred and twenty mucous pores. Dorsal fin well developed, with twelve rays, and longer than in the Salmon, ten rays; tail a little waved, while a Salmon of the same size has it forked; and even the White Trout of six inches has this fin less forked than the Salmon of a foot. Pectoral fin round. Gill-covers more oval than in the Salmon; their colour pale yellow or bluish, with shot-like spots. Colour along the head and back greyish blue, shining white below, with small blotches formed by the darker crossing of the scales; dorsal fin spotted; ventrals with nine rays, caudal nineteen.

Convictions are not unfrequent, for taking Salmon with too small a mesh in the open sea, when the only proof has been that the Peal has been thus caught; and that too at the only season when this could be caught, and with the only net that could take it.

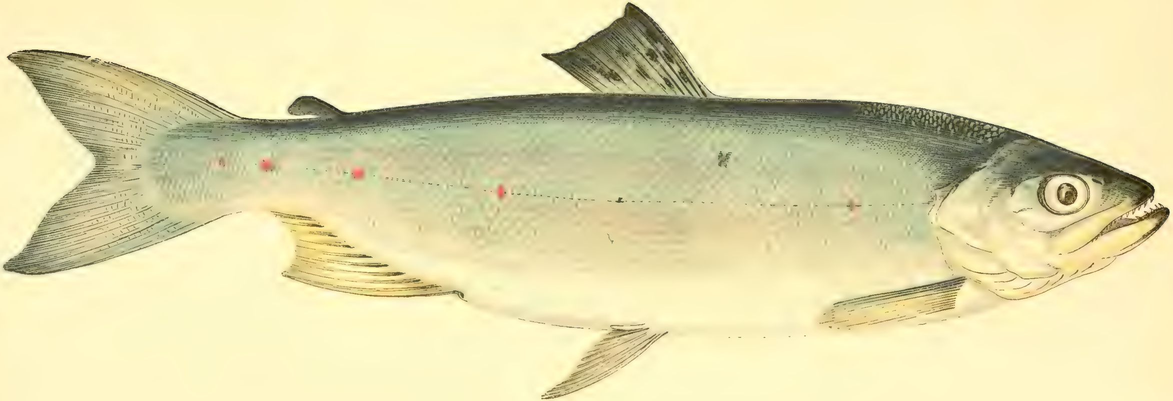
SEWEN.

Silver Salmon, besides names common to it with other fish.

Salmon Cambricus, Donovan; pl. 91.

It has been a commonly-received opinion, adopted without much inquiry, that the Sewen is only a variety of the Peal, and by many also that both these fishes are no other than an early stage of the Salmon, but modified perhaps by particular circumstances; and there is reason to believe that in many instances these species, and also the Sea and Salmon Trouts, have been confounded together; an unfortunate circumstance, as we have already hinted, for many poor fishermen, who have been convicted and severely punished for fishing with too small a mesh for the Lord of the River in the open sea, when, in fact, none such could have been caught, and they were only in the hope of obtaining the smaller and less valuable fish. A portion of this mistake has arisen from the confusion of names by which these fishes have been designated, for it appears that in many places the Peal is called a Sewen, and the Sewen a White Trout or Peal, while the Salmon in its younger state may pass for either of them. But after having carefully examined these fishes, for the opportunity of doing which I am indebted to Edmund T. Higgins, Esq., I have come to the conclusion that the Sewen is a distinct species, as Donovan also thought, and in this light we treat of it accordingly.

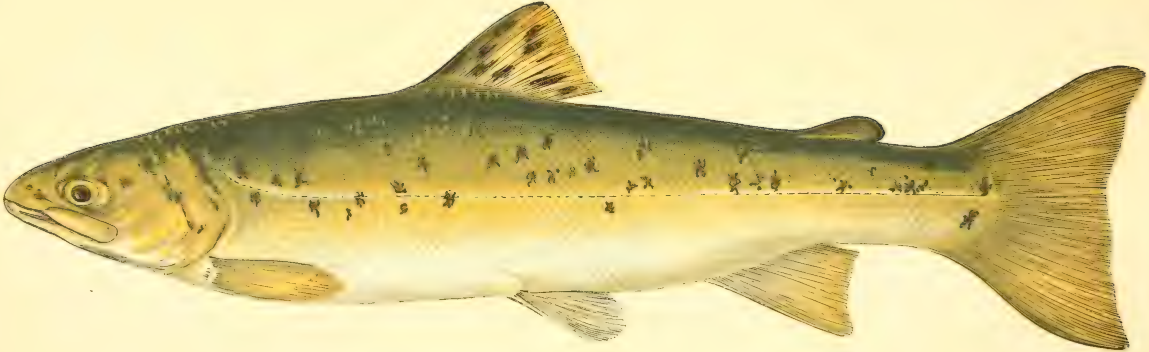
In Wales it is the general belief that this fish is not found anywhere but in that portion of the United Kingdom; and even there it is said that it is only met with in those rivers which run towards the west. It seems probable, also, that its



range at sea is as limited as when in fresh water; for there are one or two rivers on the north borders of Devon and Cornwall, into which, as it comes along the opposite shores of South Wales, it might be supposed at least sometimes to find its way. Yet such does not appear to be ever the case, although a transfer of the breeding fish, as has been accomplished with the Salmon, would probably be successful, and thus a highly-delicious species might be made to have a more extensive range. That it has not excited more general attention is to be explained by a remark made by Sir Joseph Banks to Mr. Dillwyn, that it was of too delicate a structure to be conveyed to the London market, where hitherto it has not been seen.

On inquiring among fishermen well acquainted with this fish, I learn that they ascend their favourite rivers to spawn in autumn, and the roe is deposited usually in October and November, in rocky ground, not in such shallow water as the Salmon; but beyond this the particular situations and mode of development have not been closely attended to. The young go down to the sea in March and April, at which time they possess the common character of the family, in bearing a resemblance to the early growth especially of the Peal or White Trout, from which, and the young of the Salmon, which are clothed with the silver scales, they are then not easily distinguished. As however these young of the Sewen are said to weigh in early spring a couple of ounces, or more, it may be questioned whether the fishes to which these remarks apply may not be in many instances the growth of the beginning of the second year, confounded with those of an earlier growth. It seems certain, at least, that early in July an emigration of larger fish takes place, but whether they remain until they spawn, or how many return to the sea before or without spawning seems uncertain. Mr. Dillwyn and his friend Mr. Talbot had remarked that males had not been discovered among those which bore the name of Sewen; but this is corrected by many of the fishermen, who report that the male is just as common as the female, and they add that this fish readily takes a bait, especially in the form of an appropriate fly, which is seized with a leap and plunge, and with the habit also that when the hook is felt, instead of running off with a tight line, it rushes often towards the fisherman with the prospect of breaking loose with a jerk, in which its strength is exerted to advantage.

The Sewen is said to attain the weight of twelve, or even sixteen pounds, but half that size is more common; and it is best described by reference to the Salmon or Peal, with both of which it has been confounded. As compared with either of these it has a stouter head, and a deeper body; a larger eye, which, as compared with the Salmon, is proportionally nearer the snout. The under jaw is rather more protruded; in the jaws and vomer the teeth are more like those of the Peal than of the Salmon. Scales on the body much smaller than in a Salmon of equal size; and the portion of the body bearing scales more lengthened outward toward the border of the tail; the false rays of that fin springing nearer the adipose fin than in the Salmon or Peal. Lateral line straight. Pectoral fin longer and rounder in proportion than in an adult Salmon, or than in Donovan's figure. Adipose fin smaller; but this may only apply to the individual; anal fin much longer, passing nearer to the tail; whereas in the Salmon and Peal it ends just opposite the adipose. Tail incurved, with longer rays than in the Salmon. Colour fine blue along the upper parts, silvery below, with pale pink spots of small size. Dorsal fin with dark spots: none on the gill-covers; anal fine yellow; the flesh pink.



SEA-TROUT.

CCXIV

SEA TROUT.

GREY TROUT. BULL TROUT. SEA TRUFF. PUGTROUT.

YARRELL; Br. Fishes, vol. ii, p. 71. JENYNS; Manual, p. 423. Fisherman's Magazine, vol. i, (No. 6.)

THIS fish is generally, but irregularly distributed throughout the United Kingdom, but it is only at intervals that it is met with in anything like abundance, and then only in the rivers of the north of England, Scotland, and in Ireland. Comparatively only a few shew themselves, and those of the smaller size, in the summer, although we are told that in July and August, 1864, which was a remarkably dry season with deficiency of water in the rivers, they were in large numbers in the Tweed, so as to be much more abundant than the Salmon, this latter fish being through that summer remarkably scarce. The Sea Trout is said to breed in the autumn, but this is doubtful as a general habit, from the fact that the usual time at which they enter the rivers from the sea for breeding is not earlier than November, and an example taken in the Fowey river in Cornwall, from which our figure and description were taken, obtained on the 3rd. of December, had the grains of roe of large size, so that one of them which was measured was the fifth of an inch in diameter.

At the time of the migration of this fish, as fishing with a rod is little practiced and nets are not in use, the interest it excites is less than is felt for some other kinds, and its habits in consequence are less observed; but we believe that in passing up the river they do not put forth such efforts to get up to the higher stations, or overcome difficulties, as the Salmon is known to do, and that the roe is shed in somewhat deeper water. Yet it has been taken in a smaller stream than the Salmon would willingly enter, although probably it was not there for the purpose of breeding. Mr. Thompson was the first to notice this fish in Ireland, where, however, it is not rare, although most abundant in the north, and he mentions examples of the unusual size of sixteen pounds. They have also been caught with a line on that coast at some distance from land; but I have never obtained it from nets shot in the sea in the manner or under the circumstances in which the Peal is often caught.

The food found in the stomach of the Sea Trout has been, two species of the Launce, with some vegetable substance, and in the river it will take a fly. This is particularly the case with the young when in the spring they are ready to go down to the sea; and at this time they are marked on the side with those bands which give the denomination of Parr to the young fishes of two or three species of the Salmon family which are marked with it. Indeed the young of the present species are made to contend with those of the Salmon and Salmon Trout, for the character of being pre-eminently the Parr of the rivers.

This is one of the fish which under the equivocal name of Trout is sent to London from Scotland in company with the Salmon, but it is less esteemed for the table than that fish. From experiments made in the lakes of Norway it appears that the Sea Trout will propagate when confined to fresh water, but after several years it did not reach the size that is common in situations where its habits of migration have not been interfered with.

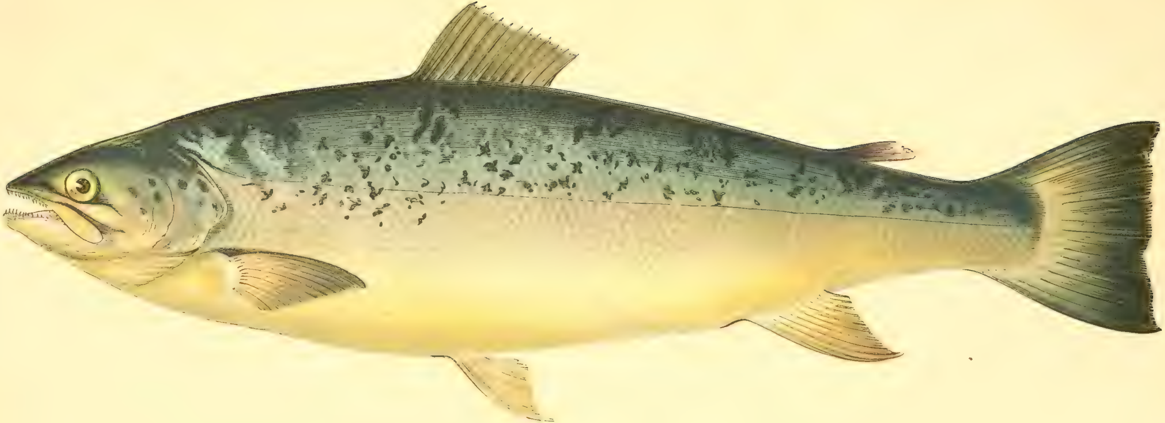
The example described measured only thirteen inches, but this fish grows to double that length; the body moderately lengthened, plump; from the snout to the centre of the eye one inch; to the margin of the gill-covers two inches and a half; diameter of the eye nine twentieths of an inch. Jaws equal when closed, mystache even with the hindmost border of the eye. Teeth along the margin of the jaws, and round the palate; a double row along the middle of the palate, (vomer) in alternate order. Tongue nearly square in front, with two rows of incurved teeth. Eleven rays in the gill-membrane. Dorsal fin at the centre of the body and of gravity, or as quaintly expressed by the Cornish local historian Carew, when Trouts are of middle growth, they are "eygall peized twixt either finne;" with twelve long rays and a few short; the pectoral fourteen rays; anal nine, also the ventral, with the usual concealed wing; the caudal nineteen, the border slightly hollowed, usually straight. Upper part of the head dark green, cheeks yellow, as are the eyes; hindmost gill-cover with shades; pectoral fins yellow; back dark, the sides yellowish, belly white. Spots on the body not uniform nor with a halo, but marked with sectional lines, a few on the gill-covers, more on the back and sides, some on the dorsal fin. The flesh red.

SALMON TROUT.

Salmo Trotta, LINNÆUS. BLOCH; Pl. 21. CUVIER.
" " YARRELL; Br. Fishes, vol. ii, p. 77.
" " JENYNS; Manual, p. 423.

AMONG writers of considerable eminence there has been much difference of opinion as regards this fish, compared with the Peal, Sea Trout, and Salmon; with one or other of which, and as we shall find, some others, it has been confounded; as they have also been with one another. But it has been our endeavour to separate them in a manner that we suppose the least liable to mistake; although in doing this we shall represent more species than are usually acknowledged by naturalists; and yet in some particular or other of the distinctions we lay down, we find ourselves supported by authorities it will not be easy to gainsay. But it is in regard to the habits of these separate species that we meet with the greatest difficulty; since in the observations which have been made on that subject, we do not feel assured of the species which has been studied, and the information collected from distant districts becomes thereby subject to a large degree of uncertainty.

In our own country the Salmon Trout is more a fish of the north than the generality of this genus; for although it occurs in the south and west of the kingdom, and our figure was taken from an example that was obtained in the west of Cornwall, yet there it is not to be regarded as common; whereas in Scotland it is equally abundant with the Salmon, as it seems to be also in Ireland; where Mr. Thompson found it in the markets in the spring, but of the usual small size of that season. He does not give the date of one which weighed upwards of seventeen pounds. It is sent to London in company with the Sea Trout, under the common name of Trout; and when in season it is little inferior to the Salmon.



SALMON-TROUT.

CCXV

This fish feeds on the Launce, which, unfortunately for themselves, are a favourite diet with all the migrating kinds of the Salmon family. But they feed also on crustacean animals, and even on some species of confervæ, or river weeds. In the river they are taken with the worm and fly; although, as being the Fordidge Trout, of which an account is given by Izaak Walton, its taking a bait in the river is strongly questioned, and this patriarch of angling was not in the habit of fishing with a fly. He represents the flesh of this species to be decidedly white, but Mr. Jenyns says its colour is red: all agree in its being highly valued at table.

The Salmon Trout might be mistaken for the Salmon in some of its varieties, as well from its size in comparison with the ordinary growth of the latter, as its generel shape; and yet in its aspect there appears a marked difference between them. This species is comparatively stouter, and carries its bulk more closely to the tail. The front also appears sharper; the gape scarcely so large; eyes somewhat larger and nearer the snout. Teeth in the vomer in a longer row, and not so prone to be shed with the advance of age. Border of the gill-covers more produced above the pectoral fin, which fin is also more pointed; dorsal more extended, its first rays scarcely so far advanced; ventrals more pointed; as are the first rays of the anal, and also proportionally longer than the following rays. According to Mr. Yarrell, the articulation at the base of the last dorsal fin ray is exactly half-way between the point of the nose and end of the tail, but I find it a little nearer the head; the anterior edge of the adipose fin half-way between the base of the last ray of the dorsal fin and the end of the tail. Colour of the upper parts and tail dark, with a tinge of blue; with in the example described, some broad patches at the beginning of the back, of a lighter colour; a tinge of pink on the cheeks and along the sides; whitish with a tinge of yellow below; a green dash behind the eyes; a strong tinge of red on the adipose fin. Some rather small shot-like spots on the gill-covers; many irregular crossed marks along the sides; ventral fins very light.

In a fish of this species from Sweden the rays of the dorsal fin were fifteen, of which the first was very short, the third the longest; anal twelve, the two last from one root; ventral nine, caudal twenty, pectoral fifteen.

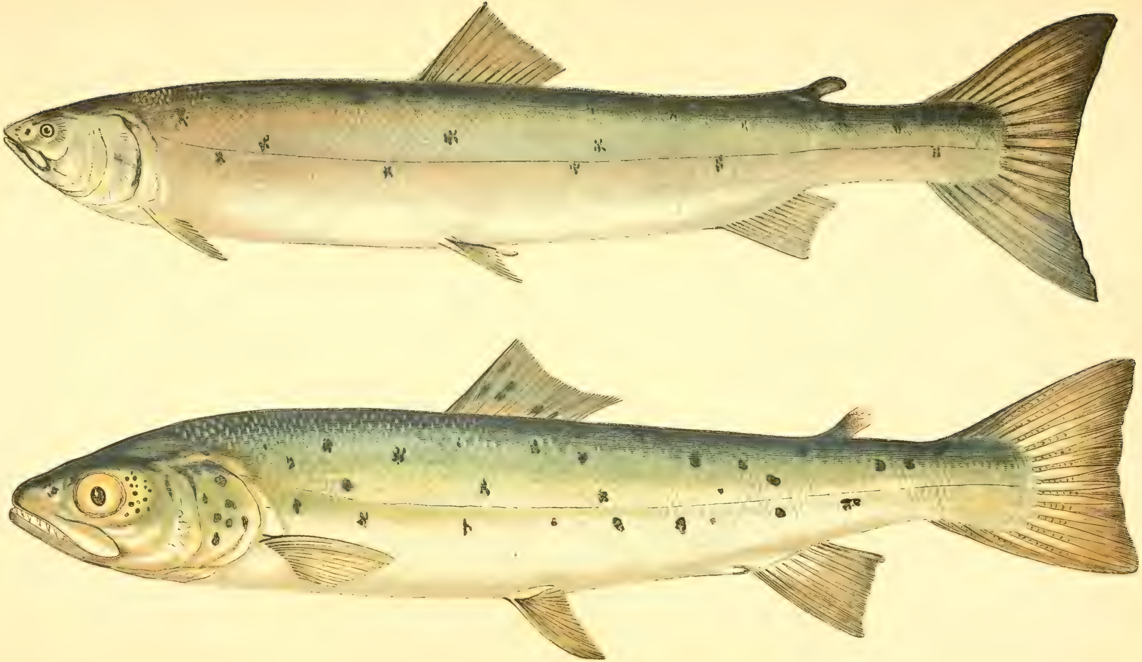
SLENDER SALMON.

Report of the Royal Cornwall Polytechnic Society for 1859.

Salmo Hucho,	FLEMING; British Animals, p. 189, which he makes the same with the Bull Trout.
Salmo gracilis,	NOBIS.

IN the Report of the Royal Cornwall Polytechnic Society, here referred to, is an account of the tåking of a fish which, in reliance on what Fleming has described of one exceedingly similar, was referred to a species of Salmon known as a native of the Danube by the name of Huc or Huech, and in Hungary as Huho or Huhko; but since the publication of the paper on the Cornish Salmonidæ, as mentioned above, I have learnt from Dr. Gunther that the characters assigned to our fish will not apply to the Hucho of Germany and Linnæus; and that this last-named species is not found anywhere even in Germany, except in the Danube and its tributary streams; to which Dr. Reisinger adds, that it is not common in any part of Hungary. It is evident that the figure of the Hucho in the work of Bloch, pl. 100, is not nearly like our fish; and the more indifferent one copied by Willoughby from Gesner is still less like it. We are therefore compelled to conclude that our fish, presently to be described, must not be referred to any known species of the continent of Europe.

The example from which our figure and description were taken was caught in the harbour of Fowey, in the month of January; and it has since been sent to the British Museum. But the figure was taken when it was fresh from the water, and a copy of it was communicated to Mr. Yarrell; whose opinion of it we give in justice to that gentleman, in his own words:—"Many thanks for your drawing of the female Salmon



1. [illegible] R [illegible] ALMON. [illegible] L [illegible]

CCXVI

with your letter, and kind remembrance of me. I have a skin of a Salmon that would have been a good match for your female. This was a Salmon that had been detained in a fresh-water pond rather more than three years, and he had in that time become in form more like an eel than a Salmon. I have also in my drawer a specimen of a *Salmo Trutto* almost as much elongated, but I had no opportunity of ascertaining any cause for this change, but probably, as in the case of your fish, destined to live in a river, the water of which did not suit it."

It is not generally safe to differ in opinion from that excellent naturalist, and especially in reference to fish of fresh water; but on the present occasion it should be remarked that the known circumstances were very different from those that were thus suggested. So far from having suffered from long confinement, the effect of which on the true Salmon is highly suggestive, this example was caught when it had just then come from the open sea. The River Fowey also is not polluted with poisonous water from mines, as are many other streams in Cornwall; and further, at no great distance of time before this a specimen distinguished by similar characters, presently to be described, was taken in the Looe, under the same circumstances; and it should be further observed that at that time the last-named river had not suffered from the copper and mundic water which now flows into it. As regards the rarity of this fish, with us of the west it does not appear to be less common than the Salmon Trout itself; and on Dr. Fleming's authority I do not hesitate to say, that however thinly scattered, it has been met with more than once at the two extremities of the united kingdom.

The length of this fish was two feet four inches and a quarter; from the snout to the border of the gill-covers (all measured in a straight line) five inches; girth round the body, which was little compressed, and nearly round, one foot one inch and a quarter. Teeth in the upper jaw and mystache strong, scattered, and incurved; a row round the palate, incurved towards the palate; none in the vomer, nor did it appear there had ever been any. The colour dull, with a tendency to blue, and a tinge of pink along the sides. Rather numerous blackish spots, with radii in three or four rays, and no light border round them. We observe, however, that in some species of this family, the radii of these spots are formed by the overlying of some bright scales across one or two dark ones; thus permitting only a portion of the dark to appear. Fin rays—of the dorsal fifteen, the first very short, fourth the longest; pectoral fifteen, ventral ten, with a separate wing; caudal eighteen. The aspect of this fish and markings of its head differ from those of the Salmon. The usual parasitic animals of the Salmon when coming from the sea were not found on it.

BLUE POLL.

WHITLING. HERLING. PHINOCK. BLUE COCKS?

Salmo albus,	FLEMING; Br. Animals, p. 180.
" "	JARDINE; Edinburgh New Phil. Journal, 1835.

MUCH difference of opinion has existed as regards this fish, as of so many others of this tribe; for while some eminent writers have viewed it as only an early or intermediate stage of some other species of this family, and of the Salmon in particular, other observers of no less authority have expressed their belief that however the name may be applied there is a distinct species to which it should pre-eminently belong. The mistakes which have been caused by these contradictions have sometimes led to the error of applying the habits of some of these fishes to the natural history of others, and a further result not unfrequently has been, that unjust and oppressive legislation has been brought into action. This has especially been the case as regards the fish now under consideration, as well as also that which we have already described under the name of Peal; but although in the earlier stages of their existence these fishes are not readily distinguished from others of the Salmon tribe, nor any of the migratory species from each other, yet when they have reached maturity there are characters to be discerned by which with little difficulty they may be definitely known; and measured by these we have no hesitation in expressing the persuasion that the Blue Poll, or Phinock, is distinct from every other.

Willoughby has remarked, page 192, that sometimes under the influence of a strong north-east wind there comes from the north to our rivers an unrecognised kind of Salmon, called by fishermen the Blue Cap, from a broad patch of blue on its head; and he further says that the sight of a single one of these fishes was hailed as a sign of success, in the large number that was to follow. No description is given by which we might be certain of the species, but we suppose it to be the fish we are about to describe, since it is the only other one known among us that is not mentioned by this author. In the west of the kingdom the name of Blue Cap is applied by some fishermen to the Salmon in the first year of its growth, and thus it answers to what is known in the north of England by the name of Grilse; but the fishermen are prepared to acknowledge another fish with this name as a separate species, of examples of which we offer a figure and description obtained from the river Looe, in Cornwall; where it is known to anglers, but at this time scarcely to be obtained, as its visits from the sea are only made during the prohibited months of winter. Indeed, in the western counties the numbers at any time are but small; but we learn that in the Camel, which opens on the north of Cornwall, towards the entrance of the Bristol channel, in its season it is in sufficient abundance to have formed an object of attention to fishermen before a law existed which laid a penalty on the taking of them. From some unknown cause they do not increase in the rivers with which we are acquainted, but they are in large abundance in the north of England, and in Scotland Sir W. Jardine found them in the summer in much greater numbers than any of the other species of the Salmon tribes. We suppose they frequent the rivers of Ireland also; but they have not yet been distinguished from the kindred species in that kingdom.

In common with the other fishes of this family the Blue Poll sheds its spawn in December and January; but sometimes as early as October. It is said that the proportion of the sexes is unequal, there being more males than females; but both of them unite their efforts in forming a channel for the reception of the roe; which channel is less deep than that of the Salmon, and not so long. The young of this species are called Skirlings, but we suppose that this name is not strictly confined to them, but is common to several species. It appears certain that the adult Blue Poll does not enter the Cornish rivers in the summer, although the want of a sufficient flow of water cannot be assigned as an hindrance to a fish of such comparatively small size. After spawning, we believe that they have all gone down to the sea before the end of February, or early in March.

We are informed that the female Blue Cocks are often sold for Salmon, and both sexes are highly valued for the table.

A female fish, which had spawned, was taken with a fly on the 4th. of March; and when first hooked it is its habit to leap out of the water, as the Peal is known to do, but contrary to the custom of the Salmon. The example here referred to measured fourteen inches and a half in length, which seems to be about the usual size; the form slender, depth in front of the dorsal fin two inches and five eighths; gape considerable; teeth in the vomer, and otherwise as in others of this family From the snout to the border of the hindmost gill-cover three inches and six eighths. Eye large, nostrils close together. On the border of the second gill-cover a mark as if serrated; the whole head rather stout in proportion to the body. The dorsal fin begins six inches and three eighths from the snout, with fourteen rays, the first very short, the third longest, last rays extended; anal eleven; ventrals nine; tail a little concave, with twenty rays, with a row of eleven or twelve short side rays; termination of the body at the tail a little crenate. Lateral line with ducts of which I was able to count one hundred and twelve. Colour of the back blue, light on the top of the head, green on the cheeks, a yellowish portion behind the eye; eye golden; brilliant white on the sides and belly; dorsal fin greenish pale blue; border of the adipose fin slight red; spots on the sides and dorsal fin not well defined; larger spots on the hindmost gill-cover, very small behind the eye. Air bladder of good size, posteriorly attached to the vent, and forward lengthened to the gullet, where it opens with a visible aperture, as in others of the genus. The skin much tougher than in the Peal. In another example, which appears to have lately spawned, there was no tint of green; brilliant blue on the hindmost part of the head; dorsal fin rays twelve. It differs from the Peal in being more slender, the eye larger, the open nostril nearer the eye than to the snout, contrary to what is found in the Peal; pectoral fin longer and not so wide.

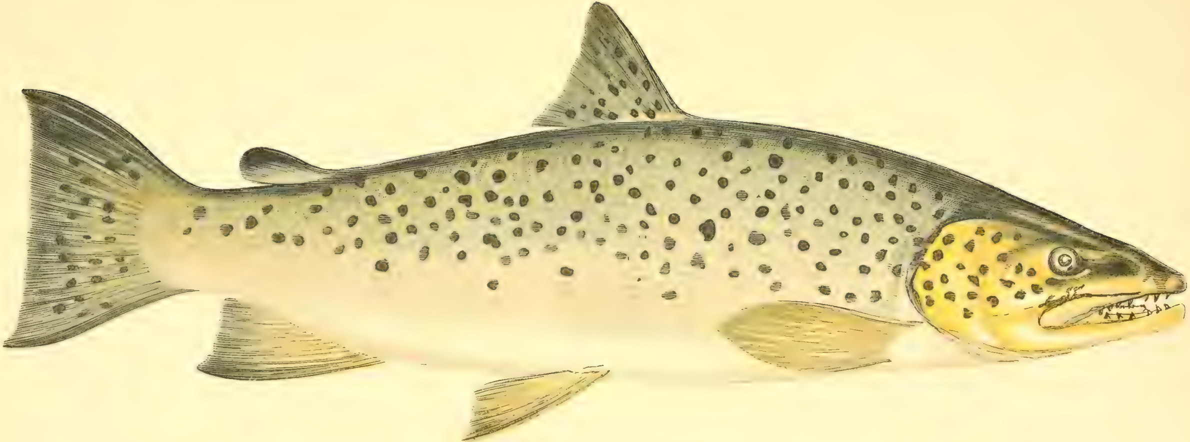
LAKE TROUT.

In Ireland, Buddagh—the Grey.

Salmo ferox, Jardine. Jenyns; Manual, p. 425.
" " Yarrell; Br. Fishes, vol. ii, p. 110.

This fish was little known to any except anglers until of late; and appears to have been first distinguished as a separate species by Sir William Jardine; but when we have heard of a fresh-water Trout as exceeding fifteen or twenty pounds in weight, we may venture to conjecture that the example referred to was the great Lake Trout. It is strictly a fish of the north, and is confined to the larger lakes or pieces of water, as well in Shetland, as the more distant parts of Scotland. Nilsson mentions it among the fishes of Sweden; and through the kindness of the Earl of Enniskillen I have obtained examples from the north of Ireland, where it is even common in places in which there is sufficient space for it to rove and feed; for it is to be observed of this species, as of several others of this family, that in a more limited space they are shorn of their full proportion of bulk and vigour. It is thus that some examples which, through the kindness of J. Morrison, Esq., M.P., I obtained from Malham Tarn, in Yorkshire, the size was much less than those from Ireland. They are found also in the Llyn y Bugail, or Shepherds' Pool, in Montgomeryshire; and it is to be remarked that in both these last-mentioned instances the pool or lake is on high ground, as if the degree of elevation was required to be an equivalent for the more northern situation of the Scottish waters.

This is a formidable fish, as well from its size, in which it is equal to the Salmon, and much superior to the general run of that fish, as from the formidable armature of its mouth, in



LAKE [illegible]

which it outdoes all its tribe. Its ferocity is equal to its weapons, and when seized by it no ordinary inhabitant of the water can hope to escape; so that next to the Pike it is the most formidable of the inhabitants of at least our British lakes and rivers. With such eagerness of hunger, the supposition may well be that this fish will fall a ready prize to the fisherman; and as its food is the fishes of its native waters, and a Trout of no small size is a ready bait, such might be the case, but that, like others of this family when of full growth, the Lake Trout is shy or cautious; so that although it may perhaps rise to a fly, as more commonly it seeks its prey only by night, it is more usually taken with lines, which are laid for it at that season. When the hook has been swallowed it becomes exceedingly furious, and no small strength is required in the line to secure it. For the table it is not highly esteemed.

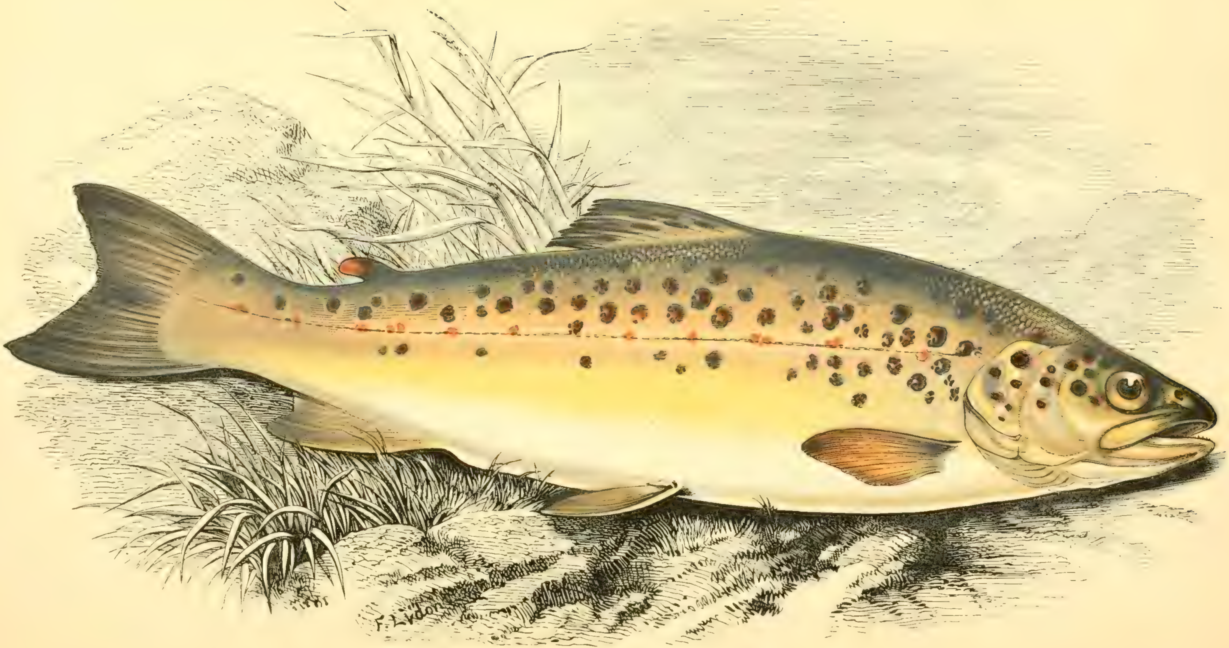
It produces its spawn at about the same time with others of this family; and for this purpose they leave the deeper water of the lakes in which they usually reside; but they do not proceed upward in the rivers which feed these lakes to any considerable distance, and presently after performing this important function they return. We may suppose that the influence of light, which is obtained best in the shallower water, is of advantage in the development of the young of this species, as well as others of this family.

I learn from the noble Earl already mentioned, that he has taken this fish in Lough Eck of the weight of twenty-eight and thirty pounds, and Mr. Thompson mentions it as exceeding even this; but the example described, which was obtained at the beginning of December, weighed only fifteen pounds; the length two feet four inches and a half; the body stout and thick, carrying its breadth and thickness backward to the adipose fin. Head large, flat on the top, snout projecting before the eyes, ending blunt. Jaws equal, gape large, mystache passing considerably behind the eye. Teeth strong, sharp, the points directed inward, distant from each other; those on the mystache continued through the whole length, with an interruption in front of the upper jaw; strong recurved teeth round the palate; a single row along the vomer, and a strong row across in front of the vomerine row, but distinct from it, and also appearing distinct from the side row of the palate Strong incurved teeth in the lower jaw, and within on each side near the front a short separate row. Tongue fleshy, with a double row of not very large teeth. Being a male there was the kipper or turned-up process on the front of the lower jaw, but not so high as in the Salmon; and it was received into a cavity in the upper jaw. Nostrils above the level of the line from eye to snout; scales on the body round, those along the lateral line shining; origin of the dorsal fin one foot and an inch from the snout; adipose fin large, and not far from the tail; its upper part widest. Width of the tail eight inches, and at its root three inches and a fourth; the border might be called straight, except that there is a small point at the corner above and below; pectorals rather wide, the upper rays curved. The colour along the back and upper part of the sides dark, tinted with blue, as are also the dorsal fin and tail; cheeks yellow, covered, as is the body, very thickly with round dots; none on the belly; pectorals and ventrals yellowish; anal dark. A tinge of purple on the sides, where the scales shine as if pearly. The dark spots on the body are also spread over the dorsal fin and tail; and even on the lower portion of the transparent cornea (of the eye.)

In an example from Malham Tarn of much less size, the muscular structure appeared more decided; the tail broader and more round; dorsal and anal fins more developed; a more decided tinge of yellow along the sides; the adipose fin reddish; and the spots proportionally larger, with a warm tinge.

In a comparison of several examples, Mr. Thompson found permanent differences between the sexes; the teeth being considerably stronger in the male; the distance from eye to snout greater; and the form of the operculum is different, that of the female approaching in roundness to that of the Salmon. In some instances the spots in the male have a pale circle of dull orange round them.

I found the fin rays of the dorsal to be twelve, anal ten, pectoral thirteen, caudal twenty.



COMMON TROUT

COMMON TROUT.

SHOT.

Trutta fluviatilis,	Jonston; Table 26, f. 1.
" "	Willoughby; p. 199, Table, N. 4.
Salmo fario,	Linnæus. Cuvier. Bloch; Pl. 22 and 23.
" "	Fleming; Br. Animals, p. 181.
" "	Jenyns; Manual, p. 424.
" "	Yarrell; British Fishes, vol. ii, p. 85.

The Trout is the commonest fish of our rivers—the most widely distributed, as well as the chief object of amusement generally to the angler; and in the comparison of it with the Salmon it is only as the chase of the hare is different from that of the fox. The catalogue of books which have been written on the art and pleasure of fishing for it has amounted to a volume; and seldom does a season pass without the addition of a new one, or a new edition of one that is old; for anglers are almost as fond of talking or reading of their art as of practising it. Under such circumstances the history of the Trout has a strong claim on our attention; and so much the more as this fish is liable to a wide extent of variation in its appearance and habits; both of which are believed to depend on the situations in which they are found; as regards the water, whether it be swift or slow, clear or otherwise; and also with reference to the kinds of food, and even the degree of light, shade, and shelter; with respect to the last-mentioned of which influences we shall presently refer to the observations of the Swedish naturalist Nilsson; and taken together the whole of them afford an illustration of the powers which are in constant exercise to modify all but the essential characters of this fish. It is this liability to change, in some degree in shape, but especially in colour and habits, which has suggested the question whether there may not be more than a single species in our rivers; but to this for the present we hesitate to return a confident answer. Cuvier and Bloch are supposed to have made mistakes in this, and we prefer to follow the example of Willoughby and Sir William Jardine in considering the several appearances in which they differ as signs of variation only. In truth, we do not feel ourselves competent to decide at what point the line of distinction as regards species in this case should be drawn; since within the sphere of our own observation we have been witness to changes that have appeared to alter the identity of some varieties of this fish, while we have been confident of their being the same individuals; and we have known others that from apparently long-continued existence in one sort of form and colour, might be regarded distinct, but which under change of external circumstances have returned to a near resemblance of the usually common type.

We take in the first place as our example the Common Trout of our rivers and brooks, the history of which is without obscurity, and by comparison with this the habits and forms of other and perhaps more doubtful kinds will be better understood. The Common Trout is a fish of much activity, and delights in clear and rapid streams, with a preference for such as flow over a clean and gravelly bottom. There it swims, usually and especially in cloudy and cold weather, low in the water where the river is not deep, and with its head against the current it maintains its station, perhaps near some eddy, with a watchful eye for every moving object. A worm or small shell-fish is acceptable, and it leaps eagerly at a fly that for a moment may stray or settle on the surface; but when larger grown it gives a preference to a small fish, and an unfortunate minnow, one of many in a sportive assemblage that are unconscious of fear or danger, is a temptation not to be resisted. It also watches the spawning of the Salmon to devour the roe in spite of the vigilance of the parents, and gorges itself with the helpless young ones as they show themselves above the gravel, within the shelter of which they had long lain hid; but here, as with the imitated minnow, their eagerness leads them to their fate, for the angler supplies himself with the coveted material as one of his most attractive baits. We have not thought it necessary to enter at any considerable length on the subject of the amusement of angling, as that has been treated of in so many volumes; but although medicated baits have been long neglected or discarded by British fishermen we will venture a reference to one mentioned by Bloch, as we have no recollection of having seen it referred to by any English writers. It is formed of a mingling together of castor and camphor with the aid of heat, and while yet in a melted state a piece of linen is dipped in it and kept for use, a slip of it being wrapped about the hook.

The practice of fishing with a fly has been thought almost peculiarly English, and of ancient date in this country, and Duhamel in France copies all that he has to say of it from Walton and Cotton; but in both these particulars there is reason for doubt. The "Book of St. Albans" gives some directions for what it terms "dubbing," a practice referred to by Izaak Walton, and which in some distant degree bears a likeness to the modern method of fly-fishing. But neither does this dubbing with a fly obtain a principal place in this old treatise, the very little of which appears to limit it to "Fysshynge wyth an angle," or earthworm; nor was the patriarch of the art, Izaak Walton, much better versed in it, for it is to his friend Charles Cotton we are chiefly indebted for what afterwards grew to be a new phase in the art. And again, although it is often said that the Trout was unknown to the ancients, or unrecognised by them, there is evidence that not only was it common and fished for in Macedonia, (as in the lakes of Italy,) but that the method of taking it with a fly was in use in the former country.

Aristotle had spoken in a cursory manner of a fish, the name of which is read as Thrissa, but which the learned Gesner supposes to be more properly Thrassa and Thratta, and that it was the same with the Trout; and that the fish itself must have been known to that eminent philosophic naturalist, himself a native of Macedonia, is clear from a narrative of Ælian; although of the name of the fish, as being local, the latter expresses his ignorance. He says "I have received information of the following method of catching fish in Macedonia. In the river Astræos, which runs between Bernæa and Thessalonica, there are fish which are ornamented with spots of different colours, but the names they bear are best learnt from the people of Macedonia. Their food is the flies which frequent that river; and these flies differ from any that are found elsewhere; for they are not only unlike bees and wasps, but they unite in themselves the likeness of all these insects. The people of that country call them hippuri —horseflies; and as they fly near the surface of the water they are easily discerned by the fish, which therefore glides gently to the place where their shadows fall, and, just as a wolf snatches a sheep from the flock, with a gulp it seizes the fly, and instantly plunges with it into the depth of the stream. This has been noted and copied by the fishermen, but with some variation, for they do not employ the natural fly, which will scarcely bear the handling, but they imitate it by art. A small quantity of purple wool is wrapped round the hook, and a couple of wings are added from yellow neck feathers of a cock. The rod and line are each four cubits long, and this contrivance, when skilfully cast on the stream, is found eminently successful."—(Hist. of Animals, B. 15, C. 1.) It was in Germany, and there only as far as we are informed, that fishing for Trout was formerly forbidden to all but the privileged, and in some States the penalty was the loss of a hand.

Within a certain range of temperature, from the far north of Europe, and perhaps of America, as also in brooks high up towards their source in lofty situations, to so far south as Italy, the Trout is a common fish even in places where no other fish is found. Sir John Malcolm discovered it in a stream of a mountain in Aderbijan, a province of Persia; and Bishop Heber observed it in the Himalayan Mountains, although it does not exist in the lower districts of India. On the other hand Captain Parry found it, or a kindred species, in a lake in Melville Island, where the temperature falls to minus 55°. But everywhere its habits vary with the season; for when young and in summer it prefers the shallows; but as the sun loses its power it retires to the deeper water, and shelters itself under the protection of some overhanging bank, or the knarled root of some projecting tree; of which it is the belief of anglers the most likely to be chosen is the willow. To this the older fish resort on the appearance of danger; and from this they do not often wander far away; for, contrary to their habits when young, the aged Trout is nocturnal, and it is by night that its courage enables it to sally forth with eager and even ravenous appetite, to seize whatever it finds in motion, and is able to overcome. A rat or frog is not at this time an unwelcome prey. In summer, however, and when no better shelter is near, a casual hiding-place, at least to those of no large size, is beneath a stone in water that is not deep; and in this situation they are sometimes caught by a practise which Willoughby seems to intimate as only known in England. There is reason to suppose this fish feels even a pleasure when a tickling action is felt by the motion of fingers, as they are gently pressed along the under portions of its body; for it remains still until an opportunity is afforded of grasping it at the gills, and thus securing the capture.

The roe is shed on the approach of the colder months; and for this purpose these fish proceed upward to the more retired and shallower brooks, and as near as may be to their source. It is covered with sand or gravel in miniature imitation of the actions of the Salmon; but the grains are developed in a shorter time than are those of that fish. In a course of observations referred to in the "Zoologist" for 1855, it was observed that from the time of bursting the egg to the full development was fifteen days; but before this, and afterwards, they are exposed to devastation similar to that which when a little grown they inflict on others; and it has been remarked that the Minnow is one of the principal devourers; but the injury thus inflicted on the race is soon afterwards repayed with vengeance.

The growth of the young Trout is speedy, but much of this depends on the sort of food that comes in their way; and we may judge that the bulk which they at last reach will greatly depend on what they obtain, of quality as well as quantity, at their outset in life; for sometimes there are districts in the same river where the fish are found of larger size than in any other part of it. In a set of trials made by Mr. Stoddart, examples were placed in three separate tanks, in one of which they were supplied with worms, in another with living Minnows, and in the third with those small dark-coloured water-flies which are to be found moving about on the surface under banks and sheltered places. The Trouts fed with worms grew slowly, and had a lean appearance; those nourished on Minnows, which, it was observed, they darted at with great voracity, became much larger; while such as were fattened upon flies only, attained in a short time prodigious dimensions, weighing twice as much as both the others taken together; although the quantity of food swallowed by them was in nowise so great. We think that the mingling of these sorts of food would have been still better; but it is known that the circulating juices or blood of many insects possess chemical properties very different from that of the higher animals; and the influence of which on creatures which feed on them must be stimulant as well as nutritive. Cantharidine in a species of beetle, a strong acid in ants, and ammonia in millepedes are familiar instances of this; and the minute flies, (*Empedes*,) which in a winter's gleam people the sunbeams, would be frozen to death if their blood were not composed of a fluid more powerful in resisting cold than a mixture of milk and water, or the blood of a mouse. But the young Trouts soon scatter themselves through the river, and everywhere shew themselves ready to take a bait or rise to a fly; but ready also to be scared by any passing object. In this indeed their course is often remarkable; for they will remain without fear close to the wheel of a mill while it is dashing round, and the water falls in a cataract; and they will even spring towards it when alarmed; but the sight of the human figure or other moving object will terrify them greatly.

The Trout does not recover its health and appearance very speedily after spawning; and yet, in Cornwall at least, it has not unfrequently been caught with a fly in good condition in January and early in February; but it is probable that these examples had not shed the roe at the usual season, as is the case also with, at least, the Salmon; and it may be such as these which have been found ready to perform this natural function early in July; as we have known them.

Nilsson appears to think it strange that the Trout is never in the open sea in the Baltic, while so many other fresh-water fishes are known to leave the rivers and pass into it; but this remark will not apply to the Trouts of our own streams, which have been noticed many times in the month of May to be quitting the river for the deep Atlantic. To satisfy myself of this I have procured an opportunity of having them taken in the salt-water with a net; and a well-grown Trout has been brought to me, that was caught at a considerable distance from a river or fresh-water. Under such circumstances a material alteration takes place in the colour of the fish, which becomes of a rich dark brown, with an aggravation of the other characteristic tints. It is believed that these migratory examples in no long time return to their native river; at which season again their appearance is so changed that they have been judged a distinct species; and we believe that they are the same which Dr. Knox has denominated the Estuary Trout.

It is not easy to ascertain the age to which a Trout may reach, and Lord Bacon assigns it a limited date, but without giving any evidence on the subject. We know the dangers to which all of Salmon family are exposed; so that few of them can be supposed to live out half their days. But an exception has been made in two or three instances in favour of some examples of the Trout; and we are informed that a farmer near Pontypool had a fish of this kind captive in his well for twenty-seven years; during which time it had not increased in size. And this is exceeded by one mentioned by Daniel, in the Supplement to his "Rural Sports," which is recorded to have lived for twenty-eight years in a well at Dumbarton Castle, and which was the weight of a pound when first conveyed thither; but even this is greatly exceeded by an instance mentioned by Mr. Yarrell, where a Trout is said to have lived at Broughton, in Furness, for fifty-three years.

Daniel's account of this fish of Dumbarton Castle may be thought interesting by those who have not had an opportunity of seeing the original work. He says that "the Garrison of Dumbarton Castle, in Scotland, was thrown into general lamentation by the sudden loss of its oldest veteran, who had served therein, a general favourite, for the long period of twenty-eight years." It was "a Trout, which having been caught by an officer in the river Severn, was put into the garrison well, that flows to the surface, where in time it became so tame as to receive its food of bread from the hands of the soldiery, in the water. When first taken it weighed little more than a pound, and it never afterwards increased in size." The instance here given was a case of solitary, and therefore might be supposed unnatural confinement; but the same writer mentions an instance where a Trout of large size had been known in a district of the Clyde for almost twenty years, during which "it eluded every artifice that the ingenuity of the sportsman had devised" for taking it. It at last left its usual haunts in consequence of the shifting of the gravel of the river, but there is no record of its having ever been caught.

The following narrative, derived also from Mr. Daniel, will not only amuse, but serve to shew that a moderate degree of confinement will not limit the growth of the Trout, nor interfere with its appetite. Mr. Toomer had built a stew in which he fed many Trouts, one of which, that weighed three pounds and a half, had been caught in the river at a small distance, and its size and strength soon enabled it to become the master of all the others that were in the stew before him. In about a year this fish, which had received the name of Fuller, and was an object of particular attention, had grown to about nine pounds, five of which had been added to his weight between March and October, at which latter date its length was twenty-seven inches. Its appetite was great, as was its activity; and the body was beautifully spotted. The food, which was not always abundantly bestowed, was worms, minnows, or the entrails of a calf finely chopped, but unless much pressed by hunger it neglected them by day. It is at an hour before dark that it begins to move about, and then Fuller begins to exercise his tyranny over the rest. He chooses to feed alone on the food thrown to him, and not at all in haste; but when he looks round, all the smaller Trouts dart off into their hiding places, at which time he sails round to see that they have all withdrawn, and he repeats the circuit at every little interval of his feeding. About a hundred and twenty-five minnows formed the complement of a meal, and, in devouring these, woe be to any one of the smaller tribe that ventured to intrude; except, indeed, a single favourite, which he appeared to have selected for a companion. It was only when the feast had ended that others were permitted to scramble for what was left. The greatest amount of activity was when the wind was brisk. Fuller's fate was at last unfortunate in being stolen from the stew.

It is scarcely necessary to say that the Trout is highly esteemed for the table; but there is great difference according to the situation in which they are caught.

Instances have been reported not unfrequently of the very large size to which this fish has sometimes grown; but in the generality of cases it is probable that this is a mistake, which has arisen from confounding it with the Lake Trout: and the error may have been committed the more readily, because that large and voracious fish is found to be an inhabitant of some districts, where from its limited size it had not been suspected to be found. We will not venture to say how seldom it is that the Common Trout will weigh more than a dozen or fifteen pounds; but an example of seven or eight is usually sufficient to excite curiosity, and those of two or three pounds are of more frequent occurrence. The authority of the Prussian naturalist Bloch is good for a large part of the continent of Europe; and he says that the usual length of the Trout is about a foot, with the weight of half a pound, and one that amounted to eight pounds was thought to be of such extraordinary size as to be a fit present for the Elector of Saxony. But examples of larger size than this are scarcely uncommon in England, where yet they are fished for with eagerness; and Sir Humphrey Davy, in his "Salmonia," quoting Lord Dedunstanville's edition of "Carew's Survey of Cornwall," says that when some small river Trout, in length two inches and a half, were placed in a newly-made pond, in the second year some of them were about twelve inches in length; in the third year one measured sixteen inches, and in the fourth year one had grown to twenty-five inches. But the shape is much alike in all these instances, except as the examples are better or worse fed; and yet there occurs such a variety of aspect as to raise the belief that differences exist between the fish of different waters to such an extent, that a practised eye may be able to pronounce from what district each individual has come. And this is the case where beyond question the variations are of one distinct species; for we leave the more obvious variations which have given rise to doubts for subsequent consideration.

In the example we select for description, which measured a foot in length, the head and body are moderately compressed, the head proportionally small, the outline rising from the head to the dorsal fin, and gradually falling again to the tail; the body covered with small scales; lateral line straight. The jaws equal when shut, gape moderate; the mystache reaching back to about the middle of the eye, armed with teeth, as are also the jaws, round the palate and along the vomer; a prominent double row along the tongue; all sharp, incurved. Eye of moderate size, rather larger than in the full-grown Salmon or

Peal; nostrils about half way between the eyes and snout. Beginning of the dorsal fin five inches back, with twelve rays, decreasing in length; pectoral rounded, with thirteen rays; ventrals close to each other, nine rays; anal ten, the two last from one root; the tail wide, concave, the upper and lower portions rounded, twenty-two rays. The colour varies with the colour of the ground, and also with the health; the back yellowish or reddish brown; cheeks and sides grey, or a rich yellow, white below. Gill-covers often sparely spotted, as is the dorsal fin, of the colour of the back; anal yellowish; but in both these fins, and almost invariably the anal, the first ray has a white border, becoming broader upward; sometimes dark at the dorsal; pectoral yellow; the adipose fin bordered with red. The sides studded with dark spots; red spots along the lateral line, and some above and below, each spot with a light-coloured border or circle. It is material to remark, as distinguishing closely-allied species, that the vertebræ of the Trout have been counted as fifty-six, and the cæca, or processes at the beginning of the intestine, under fifty in number; and the stomach itself has a membranous character, by which among other things it is distinguished from the Gillaroo.

In the several varieties of the Trout mentioned by Sir William Jardine, or otherwise observed, it is instructive to notice the accompanying influences of soil, elevation, degree of light and shade, and also the nature of the food on which the varieties are chiefly fed, and to which we have already referred; and all of which, with their combinations, will effect material changes of colour on the surface and within the flesh; as they will also on the configurations of particular organs, even, as we shall have occasion to point out, to a considerable amount of abnormal structure; or, as it is commonly expressed, of monstrosity. And this effect is rendered more considerable, so as to become even hereditary, by the circumstance that these fish in their usual habits are not able commonly to mingle with others of a different stream; so that by breeding only among themselves, a peculiarity once obtained is likely to become a permanent character of the race or district.

Sir William Jardine remarks in connection with the fish which he describes as his first variety of the Trout, and which he found in Loch Craigie, in Sutherlandshire, that the country round that lake is formed of black and white granite; the bottom of the loch of large boulders of granite gravel, or fine sand; and, except at the edge of one or two small bays, no indication of moss appeared. The colour of the water was clear sienna brown, and more limpid than that of any of the lochs of the same district. The fish were of good size, and in form came near to the accepted idea of symmetry in a Trout; remarkable for the small size of the head, arched back and great depth; the colours were of the highest brilliancy, the upper parts of a rich brown, the lower half and belly a deep golden orange, the spotting numerous but ill-defined, and often of a cruciform shape; the flesh high-coloured.

We notice this description more particularly, because on some wild downs in the parish of Luxulian, in Cornwall, there are large pools in a granite district, in which there are Trout much like those of Loch Craigie, and probably from the operation of a like cause. These pools are in an open country, and have the appearance as if they had been formed by some ancient workings for tin, and are not connected with any river; so that it is not easy to form an opinion how it has happened that any fish could have had access to them. Minnows exist in these pools, and probably constitute the principal food of these orange golden-coloured Trout. However, there are in the same pools some Trout of a larger size and different form, as well as colour, so as to raise the supposition of their being a different species. The first-named have the anterior margin of the dorsal fin and also the adipose red; the upper and lower portions of the tail not rounded, and both the margins red; with no light line on the anterior border of the anal. In the larger fish there is not a mark of red either on the body or fins; a slight tinge of yellow on the cheeks, and on the body some crossly-marked spots; points of the tail rounded; anterior border of the anal faintly white.

The second variety noticed by Sir William Jardine is found in Loch Shin, which is of great extent and depth, on a lower level than Loch Craigie, although only three or four miles from it. The bottom is for the most part rocky, gravelly, or sandy, but to a great extent its banks are mossy, and the water is of a very deep brown. The Trout were in a good condition, but remarkable for the lengthened and graceful form of the body and members; the head lengthened, rather attenuated towards the nose, the fins all lengthened, very sharp-pointed and powerful, the dorsal rising high in front; first ray of the anal fin double the length of the last; tail deeply forked, the outer points turning inward and sharp; form of the scales under the microscope longer in proportion, and considerably narrower than in any of the others. The colours not so brilliant as in the first, but beautiful, shading from a deep olive brown to greyish yellow, the spots large and distinct, round, in a pale field.

The third variety is from a small alpine loch upon the Benmire range, at a very considerable elevation. It is situated in a tract of moss, but the bottom is rocky or gravelly, the water rather transparent but of a dull tint, the rock of the surrounding country limestone. Compared with either of the former the distinctions of shape were very evident; head very round, nose blunt; the length to the extremity of the gill-covers proportionally great, body very thick, deep and round; fins thick and muscular, the lower ones rounded at the extremity; tail square. The ground colour deep purplish olive, shading from greyish to golden yellow, the whole, including the fins, glossed over with a rich shade of pale purple; the upper parts and gill-covers thickly spotted with well-defined round sepia-coloured spots, some placed in a pale space; below the lateral line thinner and more scattered; the flesh red and firm.

A fourth variety is generally of small size, and very plentiful in the district of Assynt, in Sutherland, where every narrow valley has a large number of lochs of various extent; and in a large extent of country the fish resemble each other: rather thickly formed, fins of moderate length, tail much forked; the upper parts of a rich olive brown colour, a bright yellow beneath; the upper two thirds of the body, gill-covers, and dorsal fin thickly covered with large round black spots in a pale circle; on the ridge of the back these spots are often united.

The fifth variety is from a series of lochs between Richkonich and Laxford, and in the river Laxford, which issues from Loch Strach. The body comparatively short, but remarkably deep, the fins very short, rounded and muscular, and of a Tench-like shape, different from any of the others; the head remarkable for its great length. Colours not brilliant; the spots large, but widely asunder; the flesh white and soft. From the remark that the fishermen on the Laxford term this variety the Loch Trout, and distinguish it from "the commonly marked Trout of the river," and also that the osteology of the head of the larger specimens differs from the other Trout of that river, we might suppose it a distinct species.

In the male Trout we always find the head in front of the eyes more lengthened out than in the female, and in full-grown fish of both sexes the tail is often nearly straight. In some rivers also the head is remarkably round and blunt, but we have usually supposed the species to be the same when within a limited range; in other particulars the adipose fin is bordered with red, and the only example of a doubtful kind within our knowledge was in the large examples from the pools in Luxulian already mentioned. But how great a change may be caused by circumstances appears from the Trout of the Loe Pool, near Helstone, in Cornwall. This fish is mentioned by the local historian Dr. Borlase, and had long been celebrated for its size, beauty, and excellency. Perhaps its size has been exaggerated, but I have been favoured by John P. Rogers, Esq., M.P., the proprietor of this lake, with the sketch of an example, a drawing of which was taken on account of its size and appearance when caught in fishing with a fly, in the year 1774; and which measured along the curve of the body twenty-eight inches in length, and sixteen inches in girth, with the weight of eight pounds and three ounces. I possess also a coloured drawing of an example of much less size, but taken several years since, when the fish was in its principal excellency; and from these evidences I find that the form was that which is most admired in the Trout, with the head small, the back elevated, and the whole appearance plump. The colour a rich pink on the sides, deeper on the back; the flesh like that of the Salmon, and for the table in the highest esteem, as may be concluded from the fact that so long ago as the time of the Saxon King Athelstan it was deemed worthy of royal notice, so that land was held by the tenure of keeping a boat on this lake for the royal amusement. And this reputation of the Loepool Trout continued until within a few years, when a change passed over it, and the water and filth from a tin mine was permitted to flow into it; first with the effect of diminishing the proper food of the fish, and then reducing it to the condition, as regards size, colour, and goodness, of the most ordinary inhabitants of our streams.

But there are other effects to which the Trout is liable from local situation and influences, and far less easy to be accounted for; since they involve a material interference with the structure of important organs, to such an extent as seems scarcely compatible with its existence. The first we shall mention is represented by a figure in Mr. Yarrell's work, vol. ii, p. 108; where the upper jaw is deficient, while the lower jaw is of the usual length. In other particulars this fish does not differ from other Trouts; the most remarkable circumstance concerning it being, that it is not a merely casual deformity of an individual, but is common in lakes or pieces of water which lie at some considerable elevation in hills of great height. Such is the case in a small loch called Loch Dow, near Pitmain, in Inverness-shire; and a variety closely resembling it is found in Lough na Minna, in the county of Clare, in Ireland. This latter lake is on the top of a mountain, nearly seven hundred feet above the level of the sea, and four miles from it; and there are other deficiencies of structure, which are chiefly or solely seen in lofty situations, which we have seen recorded, or have ourselves been witness to.

So long since as the times of Giraldus Cambrensis, in the twelfth century, it had been noticed that in the Llyn y Cwn, or Pool of Dogs, in Wales, there was a Trout which, I suppose not invariably, was deficient of the left eye; and the same was said of the Perch and Eel, which were found in the same water. Strange as this may appear, we learn from Mr. Hansard's "Trout and Salmon Fishing in Wales," that as regards the Trout, the fact has been confirmed by a fisherman of that neighbourhood, as also by the Hon. Daines Barrington.

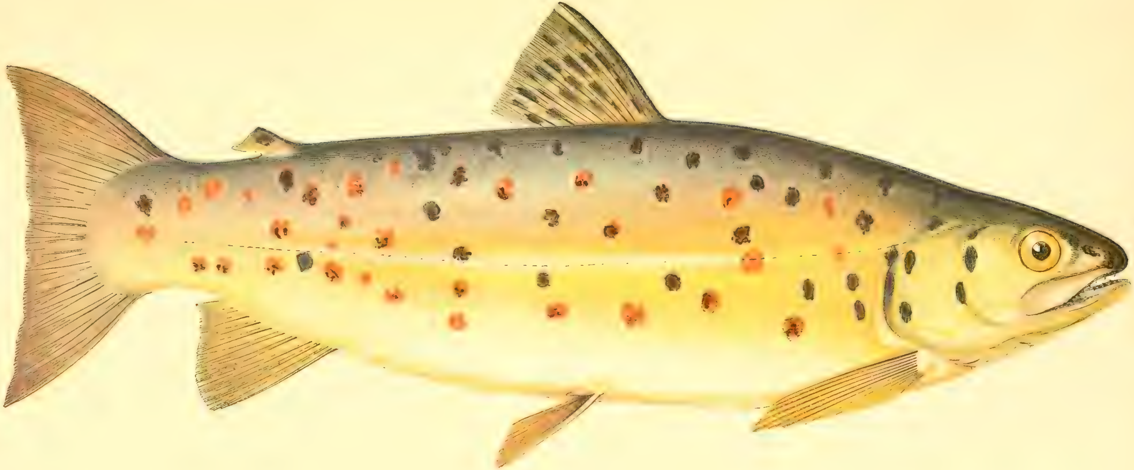
A Trout with a remarkable distortion of the spinal column into an arch at the situation of the adipose fin, is also reported from the same lake; and Dr. Fleming says that the same occurs in the River Eynion, in Cardiganshire. I have also obtained it from Caldew, in Cumberland, where they are common; and in these examples, of which two were sent to me, the head appeared unusually large; the hump or elevation was above the anal fin, which had only nine rays; and the adipose fin stood on the top of the arch, the body being again bent down at the tail; the upper rays of this fin longest, nineteen in all; its action in a depressed direction; and the arrangement of bones at its root not as in other Trouts; the line of the vertebræ so arched as to cause the distortion. But a more remarkable distortion or deficiency is frequent in a Trout which is found in Malham Tarn, in Yorkshire, for the knowledge of which and the possession of examples I am indebted to W. Morrison, Esq., M.P. The situation is on a hill twelve hundred and fifty feet above the level of the sea; the rock near is limestone, and the water clear. The fish are termed Silver Trouts, from the brilliancy of their appearance; but there is another species in the same water, which I have no doubt of being the Lake Trout, *(Salmo ferox,)* of which the colour has a strong impression of yellow. This Silver Trout is of the ordinary growth of its species, and is in good condition; but the deficiency consists in the entire absence of the posterior plate of the gill-cover, sometimes on one side and at others on the other; and in a specimen sent to me this deficiency was on both; so that in every case the fibres of the gills are bare and open to the water. About one in four or five of the Trouts caught in this place are found with this deformity; notwithstanding which the fish bore no marks of having been subject to any inconvenience, and were in good condition. Among the casual malformations a Trout was caught in Cornwall which had a second or smaller head, which appeared projecting from this natural part; and Mr. Yarrell mentions one, in which there was both a separate head and tail. Deformed Trout, some of them like those already mentioned, are also recorded by Mr. Thompson, in his "Natural History of Ireland;" so that in fact there is no fish so liable to these irregularities of structure as the Trout.

GILLAROO.

GIZZARD TROUT.

Gillaroo Trout, THOMPSON; Nat. Hist. of Ireland, vol. iv, p. 154.

THE Gillaroo is usually set down as a variety of the Common Trout, from which the ordinary supposition has been that it is only distinguished by a particular firmness, or gizzard-like structure of the coats of the stomach; and it has been further believed that this thickness of the stomach is caused by its habit of feeding on shell-fish or other hard substances. Of the particular structure of this organ we shall presently give an account; but the alleged cause appears the more doubtful, as it is found in this fish in its very young condition, and the ordinary Trouts which inhabit the same rivers, and at least occasionally devour the same substances, are without this particular form of the organ. It appears that the fishermen are well able to distinguish between the Gillaroo and the Common Trout; and, for myself, (having been favoured by the kindness of the noble Earl of Enniskillen, whose promptitude in furnishing me with supplies of this and other fishes of Ireland demands my earnest acknowledgments,) from a close examination of them I feel no hesitation in expressing my opinion that this is a distinct species from the Common Trout; and in this it is a satisfaction to find myself supported by Mr. Thompson in the work above referred to. That the instinct of this fish may lead it to feed more freely on river shell-fish than the Common and Lake Trouts which frequent the same rivers, is highly probable; and it is probably better able than they to crush and digest them; but it also takes freely a fly and worm, and it is to be regretted that its other more peculiar habits have not hitherto been closely studied. It is

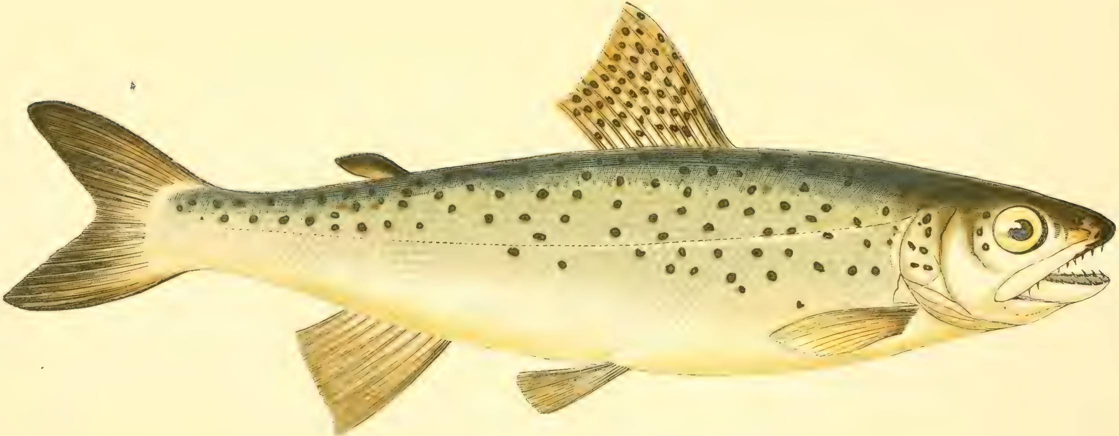


GILLAROO

acknowledged, however, as a delicate fish for the table; and, as in some rare instances, it has been suffered to grow to twenty-four pounds, it may sometimes rival even the Salmon in the esteem of the epicure.

That eminent physiological anatomist, John Hunter, remarks of the stomach of this fish that it cannot justly be ranked as a gizzard, as it is sometimes described, since it wants some of the most essential characters of that organ, which are—a power and motion fitted for grinding, and the horny cuticle. But the stomach of the Gillaroo is more circumscribed than that of most fish—better adapted for small food, and endued with sufficient strength to break the shells of small shell-fish, which will most probably be best done by having more than one in the stomach at a time, and also by taking pretty large and smooth stones into the stomach, which will answer the purpose of breaking, but not so well that of grinding. But this stomach can scarcely possess any power of grinding, as the whole cavity is lined with a fine villous coat, the internal surface of which appears everywhere to be digestive, and by no means fitted for mastication. The stomach of the English Trout is exactly of the same species with that of the Gillaroo, but its coat is not so thick by two thirds. To this Professor Owen adds, (Lectures, part 1, p. 234,) that "it is the ascending or pyloric half of the bent or siphonal stomach that has its muscular parietis unusually thickened, by which it is enabled to bruise the shells of the small fluviatile testaceans that abound in the streams in which this variety of Trout is peculiar." It has been believed that this Trout is confined to Ireland, where, indeed, it is so generally distributed, that it would be superfluous to specify any particular rivers or lakes; but I am informed by Charles W. Peach, Esq., who has long resided at Wick, that it is found also in Scotland, at least in a small loch near Inchnadamff Assynt, in Sutherland.

Of two examples laid side by side, one was more slender towards the tail than the other; but the one selected for description measured ten inches in length, whereas instances are mentioned where this fish has measured nearly thirty inches, with a weight of about twenty pounds; but compared with the Common Trout it is always far stouter, and much more robust. Depth of the specimen in front of the dorsal fin two inches and a half, rising higher at the back, and deeper at the belly than the kindred species, compared with which also the under jaw is shorter and more feeble, the snout more obtusely rounded, the setting on of the pectoral fins thrust more forward under the plate which borders the gills, and which is turned up to give them place; the pectorals and ventrals also proportionally longer; the anal rather smaller; the tail less expansive. As regards colour, it is probable that the Gillaroo is as much liable to variation as the Common Trout; but the specimens under notice nearly resembled each other. On the head brown, bluish brown along the back; higher portion of the sides tinted with pink, verging into yellow, and on the belly white. Cheeks yellow, as are the pectoral, anal, and ventral fins; the dorsal dusky, with black spots and pale anterior border; adipose fin dark, with a black spot, but without a red border, as in the Common Trout. Mr. Thompson mentions some bright red spots on this fin, but he says nothing of a red border or a diffused redness. Vermilion spots are scattered over the sides, with no particular reference to the lateral line; there are also numerous dark spots on the cheeks and along the back, but none of these spots are encircled within a light border, as usual in the Trout. The teeth strong on the tongue; the palatine teeth wide at the base, and pointed, those on the vomer irregular; a narrow veil in front of the palate. The flesh a rich salmon-colour. On attempting to preserve the skin it was found to be softer than in the Trout, and to stretch more readily; but this might arise from the length of the journey before it came into my possession.



LOCHLEVEN TROUT

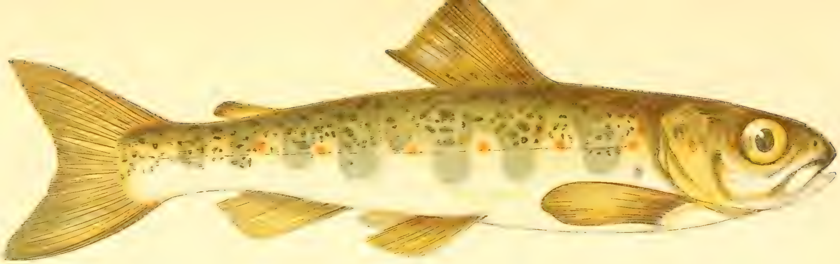
LOCHLEVEN TROUT.

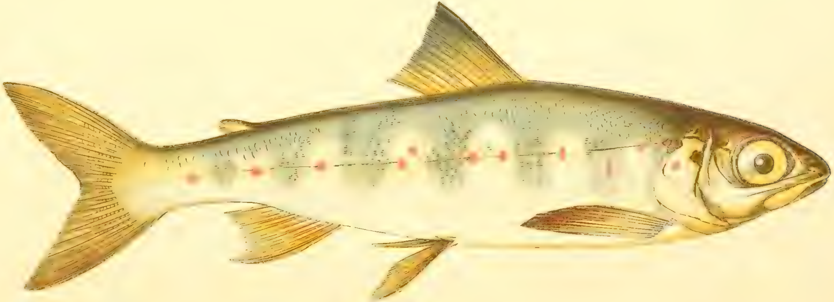
Salmo Cæcifer, PARNELL; Memoirs of Wernerian Society, vol. vii.
" " YARRELL; British Fishes, vol. ii, p. 117.

It has been supposed that this is one of the many varieties in which the Common Trout is prone to appear, as influenced by differences in water and food, of which already we have given an account; but observers who have been well qualified to form an opinion, of which we refer to Dr. Parnell, Mr. Yarrell, and Sir John Richardson, have confidently decided that it is a distinct species; and from several particulars which they have brought forward in support of this conclusion, we feel no hesitation in adopting their decision; and so much the rather as it is shown that there are abundance of the ordinary Trout in the same waters, exposed to the same influences, but from which the species above mentioned are readily to be distinguished.

But although this fish has obtained its name from a particular lake or district, to which indeed it was formerly believed to be confined, we are not to conclude that it is not to be found elsewhere, although perhaps in these kingdoms it may not be known out of Scotland. Dr. Parnell's description was from a specimen which measured a foot in length; the head rather more than one fifth of the whole length, including the caudal fin; the depth between the dorsal and ventral fins less than the length of the head; gill-covers produced behind; end of the maxillary (mystache) extending as far back as the posterior margin of the orbit; teeth stout and sharp; vomerine teeth passing along the whole way of the palate, thirteen in number. Dorsal fin placed half way between the point of the upper jaw, and a little beyond the fleshy portion of the caudal extremity of the body, with twelve rays; the third the longest. Tail concave, with twenty rays; anal ten; pectoral twelve, ventral nine.

Scales small and well fixed. Colour of the back deep olive green, the sides lighter, round dark spots on the gill-covers and sides; also on the dorsal fin, none of them with a lighter border. Anterior border of the dorsal and anal fins plain. Compared with the Common Trout, there is a considerable difference in the number of cæca or appendages to the beginning of the bowels, there being from sixty to eighty in this fish, and only about forty-six in the Common Trout; and it is on this account that the specific name of *cæcifer*, or *cæca-bearer* was bestowed upon it. But there are other, and striking differences between this fish and the Common Trout, as that the pectoral fins are pointed, those of the latter fish rounded; the body without red spots. In the Lochleven Trout the rays of the tail are proportionally much the longest, and the upper and lower portions more pointed. Colour of the flesh deep red.





1. PARR. 2.—SAMLET.

(CCXX)

SAMLET, OR PARR.

PARR. BRANLIN. PALMER TROUT. TROTTER. HIPPER.
FARTHING TROUT; AND SEVERAL OTHERS.

Salmo Salmulus,	WILLOUGHBY; p. 192, Table N. 2.
" "	YARRELL; Br. Fishes, first edition, vol. ii; but not the figure, which is too sharp and protruded before the eyes, and too high on the back.

IT has been long a question whether a little fish much resembling the Trout, and known by a variety of names in different places, but pre-eminently of late by that of Parr, is a distinct species, or an early condition of the Salmon; or at least whether it is produced by some one or more of the migratory species of the Salmon family. Several circumstances connected with the appearance and habits of these last-mentioned fishes have contributed to these doubts; some of which are still far from being settled, in spite of the efforts of several close observers, and the numerous experiments which, to all appearance, have been carefully conducted; but of which some appear to have had no further effect than the increase of the confusion that already existed.

It is known that the larger species of this family are accustomed to deposit their spawn in the same rivers, at the same season, and for the most part under circumstances not much unlike; in which case when an inquirer has endeavoured to watch their development, and the changes natural to them in the course of their growth to maturity; and for that purpose has removed the roe from its native bed, and placed it in artificial or strange circumstances, it will not appear remarkable if former doubts have not been removed, as concerns the conclusions that were drawn, or the new opinions which were advanced. As against these it was urged that it must be held uncertain whether the roe thus removed had all been shed by the same species; and also whether the strange, and perhaps unnatural, circumstances in which they had been placed, and which Mr. Shaw allows to have been different so far as the important point of temperature was concerned, and probably as regarded food also, may not have materially influenced the subsequent appearances and habits. And these doubts will appear to be so much the better founded, since from some of these experiments it has been concluded that the Sea Trout and Bull Trout are the same species with the Salmon; the contrary of which is admitted by every student of nature.

But this probable mingling of the eggs is not the only, nor even the principal cause of the confusion in which the subject has been involved. It is known that in the early stages of their existence the young of several species of this family bear so near a likeness to each other, and especially in what must in this case be regarded as the important character of a series of dusky bands along their sides, that eminent naturalists have declared their inability to distinguish them. It is only at somewhat distant periods of their growth, and not by merely an increase of size, that specific marks of their individual nature make their appearance, and others disappear; and these changes may be hastened or greatly delayed through the operation of circumstances, which hitherto appear to have been little understood or thought of; and we are again given to see a source of some of the fallacies adopted from experiments that have been made, by collecting together the young fishes of similar appearance in a river, and setting a mark on them by cutting off the adipose fin, or punching the gill-covers; with the view of ascertaining, not only whether after their migration they return to their native stream, to which extent the trial has been successful; but also as regards the sameness or diversity of the species; in relation to which inquiry the want of discrimination at the outset has of course been fatal.

But whilst these experiments have failed to establish the opinion they were at first believed to support, the more carefully laboured observations of Mr. Shaw have been trusted to in support of the belief, that the fish known by the name of Parr is no other than a particular stage in the growth of the Salmon:

and that its being found in rivers through the year, or at least the greater portion of it, is only because there are considerable numbers of the fish thus marked, of the progeny of the Salmon, which from causes yet unknown, are slower than others of the same deposit, in passing through their natural changes, even to the extent of two or, as it may happen, three years. So frequently, and, it would appear, unconsciously have these bands been dwelt on as a proof of identity of species, and so powerful has been the operation of Mr. Shaw's language and experiments on the minds of some eminent naturalists, that at last the bands themselves, without reference to any other supposed marks of distinction, have received the appellation of Parr; and it is on this account that in treating of the species now under consideration, we have judged it best to place this disputed denomination in the second place, and only as a synonym; and to distinguish the fish we hold to be distinct by its also ancient name of Samlet. The question at present therefore is not whether the young of the Salmon, and we may add of some others of the same family, may not remain in fresh water for more than a year, during which they may bear on the sides a series of dusky marks at this time, denominated Parr-bands; but whether there be not also a distinct species which bears those marks, and which by something like arrested development, is never deprived of them.

Mr. Shaw's perseverance in conducting his experiments, and his honesty in stating the doubts he felt as regards some of his observations, are deserving of great praise; but his conclusions in some particulars appear to be far from satisfactory, and, as regards the true nature of a fish he terms the Parr, the question appears to be just exactly where he found it. It appears that after the confinement of a year, these Belted Salmon were permitted to follow their inclination in passing into the river; but it is far from being shewn, or indeed rendered probable, that these were the same fish that were afterwards obtained in the river with enlarged milts, or that they were certainly of the same species. The bands themselves were no proof of this; and hence it is exceedingly questionable whether any of these diminutive examples could have been engaged in preparing the ground for the reception of the roe, an office in which the male Salmon is always expected to assist his mate; and still less is it shewn that the roe of any Salmon has ever been rendered fertile by the milt of a Belted Parr.

It is said that the Samlet or Parr is not found in any other rivers than such as are frequented by the Salmon; but if this were true it would only amount to presumptive proof, and would argue as much in favour of some other species as of the Salmon. But extended inquiry has shewn that the Samlet is not in every case an inhabitant of rivers frequented by this king of fishes, nor does the latter invariably frequent streams where the Samlet abounds. Dr. Knox is confident, ("Lone Glens of Scotland," p. 81,) that "Parr are not found in the Kale, in Roxburghshire, nor in the Tyne, in Haddingtonshire," both of which are frequented by Salmon; and Mr. Young, of Invershin, who is a competent authority on the subject, informs us that there are streams in Scotland where Parrs are found, although neither the Salmon nor Salmon Trout has ever entered them; and such is the case also in the west of England. The Camel is a river of Cornwall which opens on the north coast of that county, and there is an arm of it which is separate from the main stream by a bank which is sufficiently wide to prevent the passage of any fish that might attempt it. Salmon, therefore, are never seen in any portion of this separate channel, but Samlets are found in it in abundance at all seasons of the year.

In a "Perambulation of Dartmoor," by the Rev. Samuel Row, Vicar of Crediton, it is said, "Mr. Spence, of Mutley, has for some time been occupied in investigating the process of the growth of the young Salmon, so as to test the assertion of Mr. Shaw, that the Parr is the young of the Salmon at one period of its growth. For this purpose he has been supplied weekly with fresh fish from the neighbouring rivers, from February to August, 1847. On examining his collection I find that he has obtained fishes distinctly retaining the characters of the Parr during the whole of the months of July and August, at which time it is generally understood that the young Salmon of the previous year have lost those marks, and have acquired their silvery coats, and gone down to the sea as Smolts; at the same time the Pinks of the year are increasing in size, being in August about five inches long.

retaining their lateral markings, and instead of being silvery are yellowish in colour, like the Trout; hence it follows that this is a distinct fish from the Salmon. In this case an opinion opposed to that of Mr. Shaw would seem to be a necessary consequence."

Observations to the same purpose are contained in the work of Dr. Knox, already referred to, but they are too copious for our pages. We prefer, therefore, to give a single paragraph, (p. 87,) which shews, indeed, as we are ready to acknowledge, that the natural history of the true Parr or Samlet is not well understood, but which appears decisive of the fact that it is not the same with the Salmon in any stage of its growth. "Examine, as I have done, hundreds and hundreds of the true Salmon Smolt, while descending the rivers, sparkling with their silvery scales, and obviously 'Salmon in miniature,' towards the ocean; and the roe and milt will constantly be found at their minimum, that is, mere threads. And yet, after all these have left the river for the ocean, we almost immediately find the Parr with the milt or male organs in the highest state of development. If these were smolts not yet sufficiently grown, how comes it that their brothers of a year older growth, as is said, have left the river with the milt at its minimum, leaving behind them their younger brothers with the same organ at its maximum?"

That the Samlet is indeed to be found in some rivers in every month of the year admits of no doubt; and from a desire to investigate the subject still further, in the first week of January I procured from the Lerryn branch of the Fowey River a basket of the *Salmonidæ*, of which the Samlets and Trouts were in about equal numbers. The Trouts were in good condition, but none of them displayed any development of the roe or milt; and such also was the case with those Samlets which were less than five inches in length, of which there were several. But in those Samlets which measured more than this, or about six inches, the milts in the males were large enough to fill the cavity, and it is remarkable that of this I found in each only a single lobe. If this should on further search be found a character of the species, there would be no further doubt of their being distinct, for in the Salmon these organs are in two lobes; but I hesitate in expressing an opinion on this point, as such a peculiarity could scarcely have escaped the notice of other observers, and in this instance it may have been only a casual malformation, and no opportunity offered itself of following up the inquiry. It is certain however that in no case do the males possess the bent-up lower jaw which is so characteristic of the full-grown Salmon when the milt is enlarged; and in consequence the sexes are not to be readily distinguished. Such a one, however, I handed over to Mr. William Laughrin, A.L.S., for examination; and he afterwards assured me that the roe was considerably developed.

In support of the opinions already expressed, we add the authority of Ephemera, already referred to, jointly with that of his friend Mr. Young, together with a description of what we believe to be the true Parr or Samlet, as compared with the Trout and young Salmon, as opportunity has been afforded us. Ephemera observes of his figure of the young Salmon of four inches in length, that "it resembles the little Trout called the Parr, but its fins are much longer than those of that little fish, and its whole shape is much less perfect. Not observing those marks of distinction has led to the confounding of Salmon fry with Parr; calling them indeed 'Parr,' as Mr. Shaw and his followers do; whereas the Parr is a distinct adult fish, of the river Trout species;" to which is added by Mr. Young, "a full-grown Parr is the length of a Salmon fry of nine months old; but its fins are little more than half the size of those of the fry. It is fuller and darker in the body, and in form like that of a well-shaped Common Trout. Its cross bars or finger-marks, as they are commonly called, lie closer together on the body than the transverse bars do on that of the Salmon fry."

Sir William Jardine has defined the differences between the Samlet and the Common Trout, of the latter of which the former was once as confidently believed to be a variety as by many it is now believed to be of the Salmon. But comparing the latter with it when of equal size, I find the front of the Samlet more blunt and round; the eye differently placed, as not so low and near the gape; gill-covers differently formed in their outline; pectoral fins more rounded. The vomerine teeth are also differently placed, and extend further back towards the throat; not so stout as we find them in the Trout; but to confirm the opinion here expressed, of the distinction between the Samlet and the Trout, which may be again doubted, we quote Sir William Jardine's remarks from the new "Edinburgh Philosophical Journal," January, 1835. Speaking of the uncertainty attending the nature of this fish, he says it has latterly resolved itself into whether it was distinct or a variety or young of the Common Trout, *(S. fario;)* "with the migratory Salmon it has no connection whatever."

The forehead of the Parr is shorter than that of the Trout, the gape less, under jaw weaker, teeth finer, as is particularly seen on the tongue, round the palate, and along the vomer. In the fore part of this last-named bone the double line of teeth is more separated, or in a loop. The pectoral fin is longer and more full, the adipose fin differently shaped, and without the bright red border seen in Trouts. The first dorsal fin plain, with a dark border in front, without a light margin; anal fin plain, without the light-coloured border as in the Trout. Some examples have spots on the first dorsal fin; the red spots on the body are not surrounded with a pale ring, and they are fewer in number than in the Trout; none below the lateral line, along which they run at regular distances. The lateral bands vary a little in different specimens, but in all they differ from those of the Trout. They communicate with the colour of the back in all their breadth, but the deepest tint is low on the side, contrary to the habit of the Trout, in which they gradually grow fainter; nor is it usual with the Trout to retain any bands at so late a period of its growth. In a few of these particulars, the comparison with the Trout in its varieties as found in different rivers is scarcely borne out; but in most of them the difference appears equally great as laid by the side of a Salmon of equal size, and the comparison of the bands of colour is especially appropriate.

In confirmation of this we refer to the additional authority of Dr. Parnell, in his essay on the fishes of the district of the Forth, in the seventh volume of the Memoirs of the Wernerian Society:—"If," says he, "we compare a young Salmon of eight inches in length with a Parr of equal size, both taken from the same river in the month of May, we shall find them to differ in the following respects:—The form of the Salmon is long and narrow, the snout pointed, and the caudal fin acutely forked; the body of the Parr is thick and clumsy, the snout broad and blunt, and the caudal fin much less forked. The operculum of the Salmon is beautifully rounded at its posterior margin, with the basal line of union with the suboperculum much curved; in the Parr this part is rather produced, with the line of union nearly straight. In the Salmon the maxillary is short and narrow; in the Parr it is longer and broader, particularly at the posterior free extremity. The teeth of the Salmon are long and fine, when recent easily bent; those of the Parr are shorter and stouter, and resist much pressure. In the Salmon the pectoral fin is short, not quite one seventh part the length of the whole fish, with the fourth ray the longest; the same fin in the Parr is very long, not quite one sixth part the length of the whole fish, with the fifth ray the longest, giving a form to the fin totally different from that of the Salmon." Other marks, less decisive, are given, but it is important that "the bones of the Salmon are rather soft;" in the Parr "the bones are stout and hard." "No instance is yet known of the Parr's being taken in the sea, nor does it appear to me to be so common a fish as is generally considered."

THE CHARS.

There are few British fishes over which so much obscurity has hung as those which bear the name of Char; nor has the difficulty of determining the species for practical purposes even now been more than partially removed. A fish of this name is mentioned by Willoughby, who regarded the differences which he perceived between examples that came within his notice as being characteristic of two species, and these he called by the names they bore among the fishermen, as Torgoch or the Red-bellied Char, and the Gelt Char. In this again he is followed by his editor and friend the learned Ray, in his "Synopsis Piscium," who also remarks in his "Itinerary" concerning one of these fishes, "At Llanberis, Bettew, Festiniog, there is a fish taken called Torgoch, blackish upon the back, red under the belly—from which it obtains its name—and of which they tell some fabulous stories; as that three sons of the church brought them from Rome, and put them into three lakes, to wit, Llanberis, Llynumber, and Trevennyn, into each two. They were taken in each lake, but only at one time of the year, and at a different time in the several lakes. At Llanberis they say that they are taken only in the night, and that when it is not moonlight;" which circumstance, we may add, in regard to their habits, might have raised a doubt whether the fish of that lake might not be a different species from some of the others, as indeed has since been shewn to be the case; although it must also be remarked that more than one species may inhabit the same piece of water, and then of course the actions of each may be supposed to vary as concerns the time of their appearance and capture. But as regards the particular points of difference between the fishes they mention, both of these excellent naturalists appear to have been in some degree mistaken, since it seems certain that the fish usually termed the Gelt Char is only an individual which, as the word is intended to signify, is barren—at least for that season. Another name, the Gilt Char, has also been sometimes applied to this variety, on the slight supposition of its occasionally having a gilded appearance.

Pennant had examined some of these fishes, and although he noticed some important differences among them, both of form and habit, yet he could not decide finally on the presence of any essential distinction, so that his account of the Chars is confined to what he believed to be a single species. Fleming is of a different opinion from the forementioned writers, and describes as distinct species what he calls the Torgoch, which is his *Salmo salvelinus*, and the Case Char, which he calls *S. alpinus;* but he remarks, "Though the observations of Donovan have advanced considerably the history of this species, (the Case Char,) and the Torgoch, there is yet wanting more complete elucidation of their characters and manners." In the first edition of his "History of British Fishes" Mr. Yarrell was disposed to favour the opinion of Dr. Fleming; but this was afterwards changed, and although the figures of apparently different species are still given, the belief is expressed that they are only casual variations of a single one. This fluctuation of opinion among eminent naturalists may be received as a proof of considerable resemblance which at least some of the Chars bear to each other, as it is also of a proneness to variation in them both of shape and colour; which latter, as we shall see, forms a considerable character of this family of fishes; and to what extent these variations of opinion have influenced the minds of the commissioners appointed by royal authority to collect information on the subject of the Salmon fisheries in the year 1861, will appear from a note in their recommendations of what in future should be the state of the law; in which they seem not to be aware of even the probability of there being more than a single species of Char in the United Kingdom, and this they say in England is found only in the lake district of Cumberland and Westmoreland, where their spawning season extends from October to March. Acting on this theory, and connecting it with their views of the Salmon fishery, they are thus led to recommend that it shall be forbidden to take Chars after the beginning of September, which is, in fact, to render it unlawful to catch them at the only season when the fishery can be conducted with profit.

But this long-continued state of doubt concerning the differences in the species of this sub-family of fishes will appear the more remarkable when we find that by the persevering and discriminating researches of Dr. A. Gunther, of the British Museum, not less than five British species have been defined and described, and those for the greater part different from their supposed analogies on the continent of Europe. In comparison with the opportunities possessed by this learned naturalist in reference to these fishes, my own have been limited; but this deficiency to a large extent has been compensated by the kindness of Dr. Gunther himself, to whom I stand indebted for private communications on this, as also on other kindred subjects; as also for coloured figures in illustration of his communication to the Zoological Society on the subject of the British Chars; and it is from these materials I shall have the gratification of supplying much in addition to what is generally known of the history and distinctions of the species of this family. My thanks are also greatly due to the noble Earl of Enniskillen for a supply of Irish examples of these fishes, with notes of their distribution as observed by himself and his friends. Nor am I in a small degree indebted to Robert Embleton, Esq., already mentioned, who has supplied examples of much interest, and which will be pointed out in the proper place; and with the aid of these materials it is hoped that we shall be able to give a more satisfactory account of this sub-family than has hitherto come under the notice of the public; but still with the acknowledgment that much remains of the natural history of the Chars to reward future research.

It is thought most convenient, as well to the reader as the writer, if we follow in some degree the example of Nilsson, in arranging these fishes into a section by themselves under the name of

SALVELINI;

although we are ready to allow that, regarded as a genus, their characters are less satisfactorily distinctive than might be desired; for as regards organization they might properly be classed with the fishes of the genus *Salmo*. This Swedish naturalist remarks that, like most of our own writers, after long observation he is not satisfied with respect to the specific differences of such of these fishes as are met with in his own country; but the common character he has assigned to them is, that the head is longer than the height of the body; and especially that the colour of the back is inclined to a dark green, tinged with blue, often strewed over with pale red spots; low on the sides, and the under portion of the body white or yellowish red; the fins below yellowish red, with a white edge in front; the anal fin and tail, the latter especially, lunated. Intensity of colour is indeed a particular characteristic of the Chars; but it is to be remarked that this applies in part only to the British species; and in reference to the character which is made prominent by Nilsson, and is represented in the plates of Donovan and Mr. Yarrell, of a scattering of pale red or white spots over the back and sides, it is remarked by Dr. Gunther, and in part agrees with our own observation, that however commonly these may be seen, they are not constant; and they are also liable to disappear in examples on which they have been before conspicuous. I have seen them, however, after long immersion in spirit, in examples of the Torgoch from Llanberis, when the red colour of the under parts had vanished.

In proceeding with this portion of our subject, we deem it proper to specify the materials from an examination of which the conclusions have been drawn at which we have arrived; and these are in the first place two specimens of the so-called Fresh-water Herring of Lough Melvin, in Ireland; which, however, are not to be confounded with the Pollan or the Powan, which we shall describe, and the former of which, with somewhat more propriety, bears the same name. This Char is the *Salmo* or *Salvelinus Grayi* of our History; and a comparison of examples obtained from the same lake has persuaded Dr. Gunther that they are distinct from all the Chars which he has a knowledge of on the continent of Europe; as also, so far as he is able to discern, from all those which are described by the continental writers Heckel, Nilsson, and Rapp. And this judgment is further confirmed by about twenty other examples sent by the noble Earl already mentioned to myself, and the same number to Dr. Gunther at the British Museum; all of them males, and caught together; and it is worthy of notice that afterwards a considerable number taken at the same place were all females. Again, and in contrast to these, there have been obtained about twenty specimens of mature males of the Welsh Char or Torgoch from Llanberris, with four young specimens from the lake Coes-y-gedaul, and formerly in the possession of Mr. Yarrell; from which Mr. Jenyns derived his description of the fish he has represented as his *Salmo salvelinus*. To these are to be added two examples, one of which is of very large size, from the former Welsh lake, and furnished to myself by Mr. Embleton.

For further comparison with the British species, Dr. Gunther was able to obtain from the Lake of Constance the "Rothel," the "Ombre Chevalier" of the Lake of Geneva, four specimens of a Char from Iceland, and twelve examples from an uncertain situation; to which abundant materials I will add a couple of the Alpine Char of Loch Grannock, in Scotland, supplied to myself by Mr. Embleton.

But before entering into the question of the British species of this family, it seemed desirable to ascertain what were the fishes to be understood by the Linnæan names of *Salmo umbla*, *S. salvelinus*, and *S. alpinus*, and which are the designations that have been assigned to the really British species. For this purpose the original descriptions are found too general and unsatisfactory; but the question is settled by an examination of the names themselves, and by the situations from which the typical specimens were procured. As concerns the *Salmo salvelinus* of South Germany, Heckel remarks that Linnæus has founded the species on the tenth of *Salmo* in Artedi's genera, or the eleventh of his Synonymy; and Artedi derived his knowledge of the fish from Willoughby, who gives a description of the "Salvelin," from a specimen captured near the Austrian town of Linz; a circumstance which proves that the Linnæan name was intended for this German fish, which is still in many places called Sälbling. The best account of this fish is given by Heckel, but on a close comparison with those British examples which were within Dr. Gunther's reach, the conclusion is that none of them answer to the *Salmo salvelinus* of Linnæus. The *S. umbla* of Linnæus is founded on the ninth species of *Salmo* in Artedi's genera, or the seventh of his Synonymy, from Rondeletius, who described the *S. Lemanilacus* or *umbla*, or *Ombre chevalier* of Geneva and Neuchatel; but it never assumes the red colour of *S. salvelinus*, or of the Chars of Windermere and of Wales. In this respect it could only be compared with the Fresh-water Herring of Lough Melvin; from which however it differs in its much larger teeth, wider mouth, the maxillary (mystache) extending behind the orbit, the much more lengthened body, and the proportion of the fins. It differs therefore from these British Chars in nearly every one of its external characters, and agrees with the Irish species only in its plainer colouring and the size of its scales.

Linnæus, in his "Tour through Lapland," discovered a species which in his "Lachesis Lapponica," and also in his "System of Nature," from its inhabiting very lofty situations he named *S. alpinus;* and he follows Artedi in supposing it the same with Willoughby's British Char; as was thought likewise by Dr. Fleming; but by comparing Nilsson's description of it with British examples before mentioned, Dr. Gunther found such differences as to persuade him that they are not the same; except as applied to a species taken in a lake, presently to be mentioned, in the Highlands of Scotland, and of which also I have through the kindness of Mr. Embleton been so fortunate as to receive examples.

After noticing at some length the discrepancies which exist between the accounts of these fishes by several more modern writers, Dr. Gunther proceeds with a description, accompanied with figures, of the British species which he had examined; to which with the further aid of that gentleman and of examples supplied from the sources already mentioned, we shall be able to add two additional species; but before we enter on these particulars, as their individual habits are not distinctively described, we find it more convenient to give a sketch of the general history of this family; and thus to limit our account of the several species for the most part to a description of each of them; since it is only thus that a proper discrimination can be established between them.

It is a character of all the Chars that they inhabit the colder regions of deep waters, where the temperature is little liable to vary, and does not sink to an excessive degree. Nor are they accustomed to swift or running streams, although there is one which we shall notice—the Alpine—that frequents waters of the latter description rather more than the others, and others when proceeding to an eligible situation for depositing their roe have been known to pass through a rough current, but still without remaining in it. Their habitual residence, however, is in the deeper lakes, and usually near the bottom; for it is only when the sexual impulse prevails, the season of which is not the same in each kind, that they come near the borders or into shallow water, so as to be within reach of the net. It is then, in the colder months of the year, that they sport near the margin, and proceed in numerous assemblages to a not very considerable distance up a favoured river to shed their spawn; or perhaps some well-known shallower part of the lake itself is chosen for the purpose; but in any case the situation must have a hard or stony bottom, not unlike that of the lower depth of the lake in which they live at other seasons. It has even been noticed that when some Chars have passed into rivers which flow into their lake, but which have a sandy bottom, they have retraced their course without having performed this duty of nature.

From the fact already noticed, that all which have been enclosed in a net at one time have been males, and afterwards the assemblage has consisted of none but females, it seems probable that at an early stage of the development of the milt and roe they keep apart from each other. Yet afterwards they mingle together in an apparently indiscriminate multitude, although the season is not the same in the different species; for while some are known to shed the roe as early as October and through November, other species perform this function from December to the end of January. But whenever performed it is the time when the fishery is carried on, for the most part with nets; with which from twenty to thirty dozen have been caught at a single haul, although more commonly the quantity taken is much less than this. All the kinds of Chars are held in esteem for the table; but as they soon lose their delicate flavour, a principal use of them is by preserving them in pots; in which condition they form a fashionable dish. But to what extent the method of preparation can deceive the palate appears from the fact, that when the supply of the favourite article fails, little scruple is said to be felt in substituting the Trout in its place without fear of detection.

It is affirmed by the fishermen that Chars cannot be caught in any quantity except in the cold season of the year; and that in the summer, when they keep at the greatest depths of the lakes, only a few are to be taken with a line—too few to compensate for the time and labour that must be engaged in the work, and it is known that these fish are always slow to take a bait. But on the other hand this view of things has been pronounced a misrepresentation; and in the summer, when Chars are believed to be in their best condition, the reason assigned by others for their not being fished for is, that the fishermen at that season prefer to follow some more profitable occupation. Those persons however who amuse themselves by fishing for Chars in the summer, pursue the sport by means of a line of sufficient depth to reach the bottom of the lake, which may be with a depth of forty fathoms; and to cause it to sink a bullet of lead is employed. That these will take a bait, and sometimes even eagerly, is known by the enticement of a Minnow, which is found to be a successful lure. Dr. John Davy describes this method of fishing, which is with a lath, and on Windermere the main line measures about sixty yards, added to which what is termed the first dropper is about twenty-four yards, with eight yards of gut; the second dropper measuring about twenty-two yards; and the last, which is nearest the board or lath, that moves like a boy's plaything kite, about twenty yards; each of these droppers with the same length of gut as the first. This line is fastened to an erect pole, and as the boat is rowed gently forward, observation is directed to the line by its vibration when a fish has seized the bait.

In proportion to their size Chars seem to feed much like the Salmon, to which fish also the armature of their mouth bears a resemblance; and worms with small water insects are their ordinary food. It is only on some rare occasions that they have been known to take the angler's fly when fishing for Trout, as will be noticed when we treat of the Torgoch, or Welsh Char.

When engaged in shedding the spawn, these fish assemble where the water is moderately shallow; and this probably for the sake of light as well as air; in addition to which warmth must have as ready an influence on the development of the young as it is known to have on those of the Salmon and Trout. Dr. Davy gives a short account of his observations on this subject by remarking that on the twenty-fifth day of

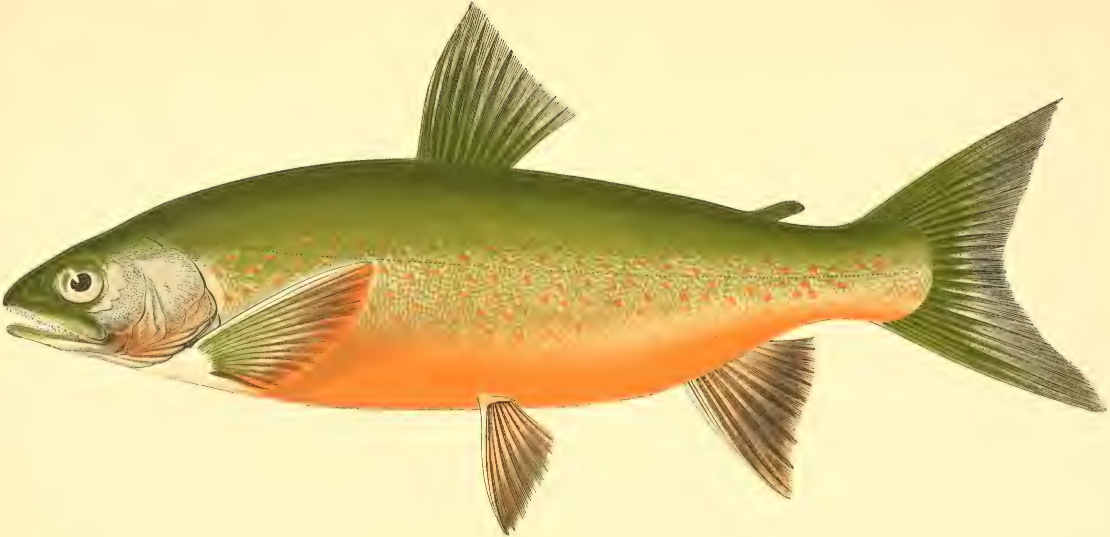
November he mingled together the milt and roe of living Chars; and then he distributed the grains, some in shallow earthen pans with or without gravel, and some in finger glasses; and then he covered the contents with water obtained from a spring, to the depth of three or four inches. This water was changed twice a day, with a temperature between 50° and 55°, and the young ones were produced in from forty-five to sixty-six days. These young Chars were very active, and readily hid themselves under stones; but it was six weeks from what may be termed their birth before the remains of the egg had become absorbed into the body, and they stood in need of a further supply of food. It may be questioned, however, whether the temperature here noted had not quickened their early development and subsequent growth in a higher degree than is natural to them; and also whether other unusual circumstances, as the absence of running river water had not a disturbing influence on their ultimate fate. Although so much smaller fish the grains of roe in a Char are little less in size than those of a Salmon, and may be supposed subject to the same laws of atmospheric action, in conformity with which Dr. Davy admits that with a lower temperature the extrication of the young will be so much the longer delayed.

WILLOUGHBY'S CHAR.

Umbra minor, Torgoch,	Willoughby; p. 196.
" " "	Yarrell; Br. Fishes, vol. ii, p. 124.
Salmo Willoughbii,	Gunther; Proceedings of Zoological Society, 1862, p. 10, pl. 5.

The Char of Windermere, but probably not the only species there.

Body compressed, slightly elevated; length of the head a little more than one half of the distance of the snout and of the vertical from the origin of the dorsal fin. Head compressed; interorbital space convex, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; teeth of moderate strength, four in each intermaxillary, twenty in the maxillary. Length of the pectoral fin less than that of the head, much more than one half between its root and that of the ventral. Nostrils immediately before the eye. The maxillary bone (mystache) extends scarcely beyond the hindmost margin of the eye; two pairs of teeth on the vomer, four pairs on the tongue. Mr. Mascall observed (Loudon's "Mag. Nat. Hist.," vol. viii, A.D. 1835,) that in the examples he met with, the bones of the gill-membranes were not in equal numbers on both sides. Dr. Gunther remarks that nearly all these bones are exposed to sight in a side view of the fish. The origin of the Dorsal fin is exactly in the middle between the snout and root of the caudal; the rays twelve in number, the first very short, fourth and fifth longest. Anal fin with twelve rays, its origin exactly in the middle between the root of the caudal and that of the outer ventral ray; the first ray very small, the five first rays obscured by being enclosed in a common membrane, the fourth longest, fifth branched. Tail fin forked, the lobes pointed; pectoral



WILLOUGHBY'S CHAR.

fin at its root not overlapped by the gill-covers, the rays thirteen or fourteen; ventral nine or ten, situated below the two last rays of the dorsal. Scales thin and small. Colour on the sides of the back dark sea-green, blackish on the back, and on the greater part of the dorsal and caudal fins. Sides with a slight silvery shade, passing into a beautiful deep red on the belly; pectorals greenish, passing into reddish posteriorly, the upper border white; ventral fins red, with a white outer margin and a blackish shade within the margin; anal reddish, with a blackish shade over the whole of the middle, and with a white anterior margin; sides of the head silvery, the lower parts minutely dotted with black. Number of the vertebræ fifty-nine. The length rarely exceeds ten inches, but it has been known above fifteen.

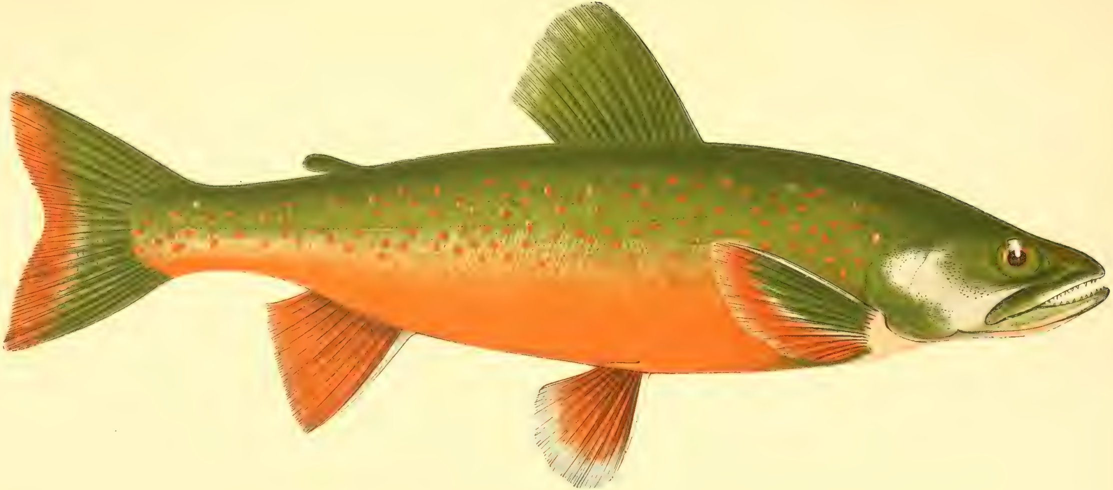
TORGOCH OF LLANBERRIS.

WELSH CHAR.

Salmo Cambricus, Gunther; Journal of Zoological Society, 1862, p. 13, pl. 6, but the trivial name since changed to *S. Perisianus*, to distinguish this fish from *S. Cambricus* of Donovan, which is the Sewen.

This species rarely exceeds a foot in length, and for the table was in high esteem, so that what might be termed a regular fishery was carried on for taking it, by which, says Mr. Hansard, a hundred dozen of them were caught yearly. Since that time the numbers have fallen greatly short, in consequence, as was supposed, of a flow into the lake of the water of a copper mine, which was believed to have destroyed the whole of them. This, however, is a mistake, since they are still obtained in some abundance; and not in this lake only, but also in Llyn Cwyllean, situated in a deep valley on the west side of Snowdon. They come up out of their greater depths in the depth of winter, and when the weather is at the coldest they sport in the shallower water close to the border, but soon again retire to their former haunts. They are taken with a worm, and sometimes are known to rise to a fly.

The body is compressed and lengthened; length of the head considerably more than one half of the distance from the snout to the line of the origin of the dorsal fin; upper profile of the head not elevated above the margin of the orbit, and is not even slightly ridged, but slightly concave; the median ridge scarcely visible. Snout rather depressed, the lower a



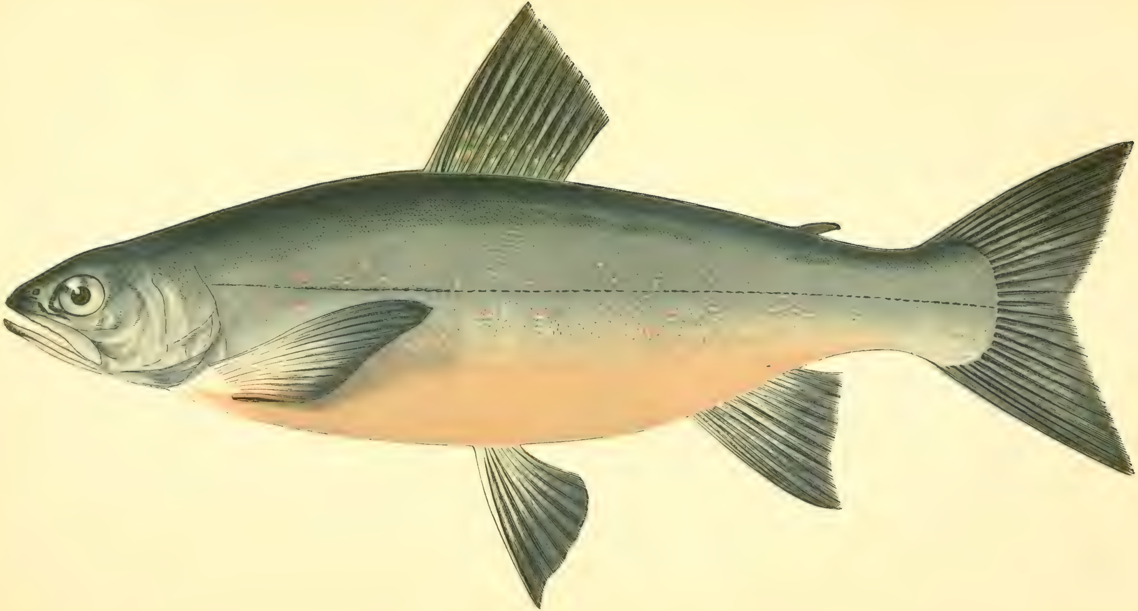
TORGOCH

CCXXIII

little curved upward and over-reaching the upper. Nostrils midway between the eyeball and end of the snout, the foremost round, open, surrounded by a membrane which posteriorly is developed into a small flap, which does not exist in the Char of Windermere, and in this species almost entirely covers the smaller, oblong, posterior nostril. By this character alone the Torgoch may be distinguished from the last-named species and the Char of Lake Melvin. The mystache scarcely extends beyond the hindmost border of the eye, and has from nineteen to twenty-one teeth, six or seven in each intermaxillary, seventeen in each mandible, seven on the vomer (where they form two sides of a triangle,) fifteen on each palatine bone, and five pairs on the tongue. Origin of the dorsal fin a little nearer the snout than to the root of the tail, with thirteen or fourteen rays, the first very small, the sixth longest. Anal fin with eleven or twelve rays, the first exactly in the middle between the roots of the tail and of the outer ventral ray; the first ray very short. Pectoral fin with twelve or thirteen rays, its base overlapped by the gill-cover, and it extends three fourths of the distance to the origin of the ventrals; ventral fins with nine rays. Tail concave. The scales thin and small. Colour of the back dark sea-green, lighter on the sides; a bright red below; the sides (often) with numerous reddish orange-coloured spots; pectorals greenish, passing into reddish posteriorly, the upper margin white; ventrals and anal red, with white anterior margins; dorsal and caudal blackish, with broad lighter margins; cheeks with numerous black dots. To this account of the colour of this beautiful fish we add from Mr. Hansard, that the hues are splendid beyond all example among the fishes of this country.

Nothing can exceed the fervid aspect of its colours when first taken. The scarlet of the body may be said to emulate the glowing redness of the fiery element; the upper part of the head and back deep purplish blue, blending into silvery near the lateral line, below which the sides are tinged with yellow, passing into orange, and then into fine scarlet towards the belly; the back and sides spotted beautifully with fine red; the flesh within a deep red. Number of the vertebræ sixty-one. Such is the description of a recent example, as given by Dr. Gunther. We think it proper to add also a notice of specimens in our own possession, which were perfect in all respects except as regards their colour.

The specimen from which my description was taken measured in length eight inches and a half, the shape stout, and a larger individual of the length of a foot to the fork of the tail, was six inches and a half in girth in front of the dorsal fin. The head is stout and wide over the top, forehead blunt, jaws nearly equal, or with the lower slightly projecting. The gape wide and mouth capacious; intermaxillary bone with teeth laid in an arched order, those in the mystache thickly placed but slight, also round the palate, but none in the vomer; veil in front of the mouth above, and a slight one below; roof of the palate arched over; fine teeth in the tongue; nostrils nearer the snout than to the eye, the anterior open and surrounded with a border of membrane, close behind it the fine pointed orifice of another. Eye rather large. The back rises gradually to the dorsal fin; scales very small; lateral line slightly raised, straight, the pores small and very numerous. All the fins have the membrane dense. The thickness of the body is carried back to the adipose fin, and more especially in the large example. Dorsal fin high, the rays fourteen, the fourth longest and two last united. The pectoral reaches three fourths of the distance to the ventrals, broad, with thirteen rays; anal fin eleven; ventral ten or eleven. Colour of the upper parts black, sides dark, thickly covered with white spots, as were other examples; belly yellow, but in some a tinge of red, this colour seeming to have vanished from the operation of spirit in which they had been preserved. Upper ray of the pectoral fin whitish, and in a less degree the border; front border of the anal white; ventrals with a tinge of orange; all besides dark. Air-bladder large; milt of small size.



[illegible] CHAR.

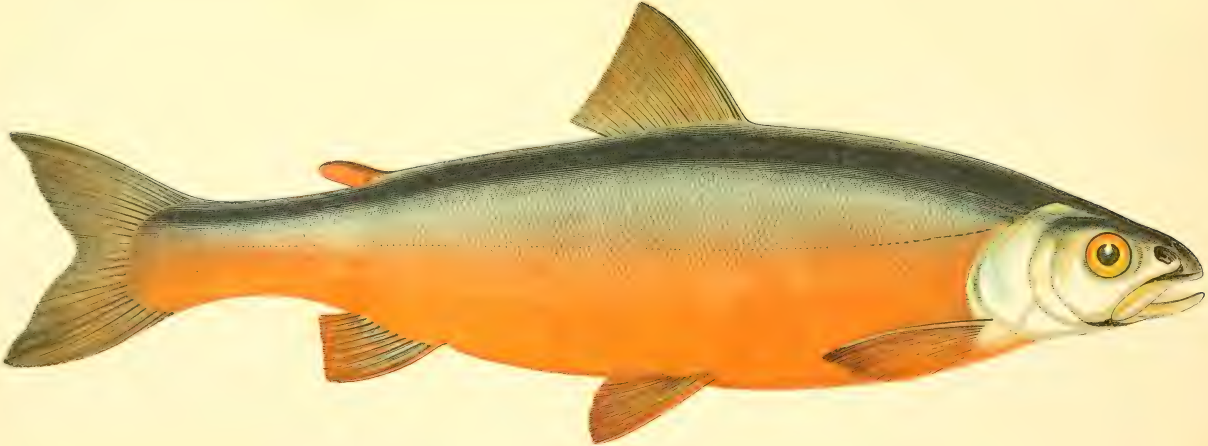
[illegible]

GRAY'S CHAR.

Salmo Grayi, GUNTHER; Journal of Zoological Society, 1862, p. 15, pl. 7; where it is called the Fresh Water Herring of Lough Melvin, but to be distinguished from the Pollan, which is also, and more appropriately named Fresh Water Herring. This Char is among the species referred to by Mr. W. Thompson, vol. iv, p. 160.

MUCH obscurity hangs over this species, as also on the two others which are to follow, so far as regards their distinctive habits. And this is so much more the case in regard to Gray's Char, as there is another which inhabits the same Lake Melvin, with which it is likely to be confounded. In order, therefore, that we may not add to the uncertainty which still exists, by describing the habits of one, which might more properly belong to the other, it is thought best to limit our notice of this and the others as enumerated by Dr. Gunther, to a simple description of each, with a corresponding figure so far as the latter are within our reach. After which we shall give a list of the situations in the United Kingdom in which the several kinds of Chars have been found; but without pledging ourselves to the fact that the individual species are to be referred generally, with one or two exceptions, to the particular lakes we have mentioned. We will only add here, as bearing on the question of the distinguishing these species of Chars from one another, a remark of Dr. Gunther, that although the colours in each are liable to some degree of variation, yet by the colours alone when the examples are fresh, the *S. salvelinus*, *S. umbla*, *S. Grayii*, and *S. Willoughbii*, may be always distinguished from each other.

Head and body compressed, slightly elevated, the greatest depth being below the origin of the dorsal fin; upper profile of the head elevated above the border of the orbit, the diameter of which is one fifth of the length of the head, shorter than the snout; interorbital space convex, with a prominent ridge along the middle, and with a pair of series of pores. Snout slightly compressed, subconical, length of the jaws equal. Nostrils midway between the end of the snout and the border of the eye; the hindmost wider and round, the anterior a very narrow vertical slit; both separated by a narrow cutaneous bridge. The maxillary (mystache) extends to the vertical from the hindmost border of the eye, and is armed with sixteen very small teeth, the hindmost rudimentary; all the other teeth small, four in the intermaxillary, twelve in each mandible, two to four in the vomer, fifteen on each palatine, and four pairs on the tongue. The suboperculum, which forms the hindmost part of the gill-cover, does not cover the exposed portion of the shoulder above the root of the pectoral fin. Dorsal fin with thirteen or fourteen rays, its origin nearer the end of the snout than to the root of the tail, fourth and fifth rays the longest. The distance of the adipose fin from the dorsal is less than twice the length of the base of the latter; anal fin with twelve rays, its origin at the middle between the root of the caudal fin and of the outer ventral ray; fourth, fifth, and six rays the longest. The tail forked, the lobes pointed. Pectoral fin with thirteen or fourteen rays, its base free of the operculum, and ending at a short distance from the ventral; ventral with nine rays, its origin below the ninth, tenth, and eleventh rays of the dorsal. The scales very conspicuous, and comparatively much larger than in any other of the British Chars; those of the lateral line not larger than the others. As regards colour the sides and belly are silvery, the scales on the sides of the back have a silvery centre and a blackish border; the back itself bluish black, belly with a reddish shade; sides with scattered light orange-coloured dots; fins blackish; the dorsal lighter superiorly; ventrals with a narrow whitish border. Head silvery, black above. We shall say more about this species when we have described the next that follows.



COLE'S CHAR.

[illegible]

COLE'S CHAR.

ENNISKILLEN CHAR.

Salmo Colei,	Gunther.
Salvelinus Colei,	Nobis.

The trivial name assigned to this species is designed by Dr. Gunther as a mark of respect to the Earl of Enniskillen, the name of whose family is Cole; and to whom science is indebted for many advantages, and both Dr. Gunther and myself for the supply of specimens of Natural History, and the kindly spirit in which they were bestowed.

About the middle of November I was favoured by the noble Earl, to whose name this species is especially dedicated, with a considerable number of these fish, from which our figure and description have been taken; and at the same time a supply was sent to the British Museum for examination by Dr. A. Gunther. They were all obtained from Lough Esk, in Donegal, but we are informed that they also inhabit Lough Elvyn in company with another species already described; and they are found in Lough Lada, with some others in the county of Wicklow.

The example described, which was about the usual size, was nine inches in length; the shape not much unlike that of the Pollan, but a little rounder; the body moderately compressed, sloping gently from the dorsal fin to the snout, which is a little rounded at the point. Eye large, the nostrils in front of it in a depression, one of them a wide cavity surrounded by a membrane, the other a slit; breadth of the head between the eyes only a little more than the extent of the orbit; and a low ridge along the top. Jaws equal, teeth in both and on the sides of the palate, with a separation between the rows in front;

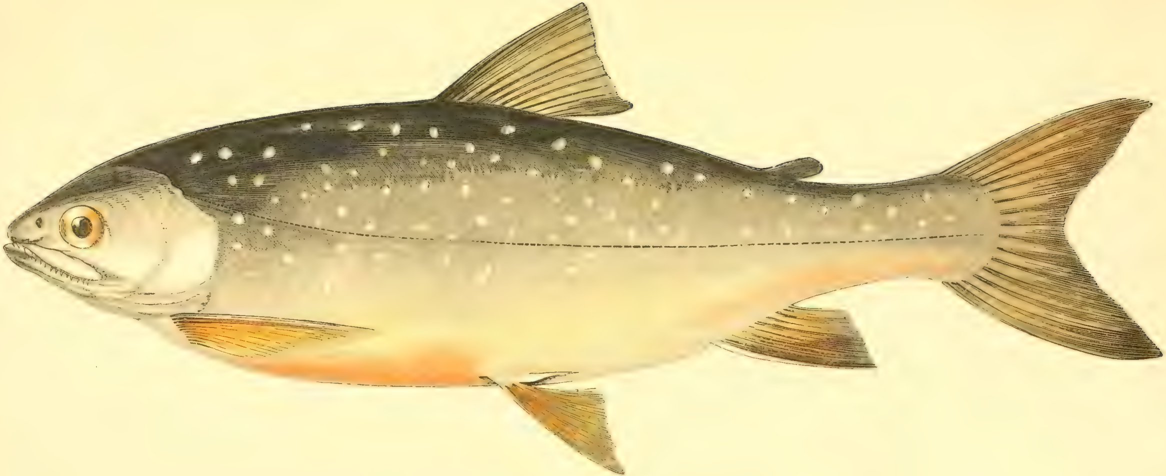
a pair of stouter teeth in front of the palate, where in one example there were three teeth; none on the vomer; two rows of strong teeth, five in each on the tongue; a veil in front on the under jaw. The body deepest opposite the origin of the dorsal fin, and this depth is greatest in the male, although the female was filled with enlarged roe, the grains of which were almost as large as those of a Salmon. Lateral line straight; scales on the body small. Dorsal fin large, behind the centre of gravity, with thirteen rays; anal wide, with twelve rays; and in both these fins the last rays spring from one root; adipose fin small. Pectorals large, pointed, in length a little less than from the snout to the border of the gill-covers, eleven rays; ventrals large, the rays ten; tail wide, forked, with nineteen rays. Colour on the head and back dark, with a tint of blue, softening off at the sides; deep reddish orange at the belly; gill-covers bright, with a tint of blue. Pectorals, ventral and anal fins tinged with orange—the last-named fins in one example with a white border in front; adipose fin reddish orange; tail and dorsal fin dark. In the male the colours were deeper than in the female.

Comparing the colours of these examples with those of the Torgoch, as given by Donovan; the latter spotted with red on the back and sides, and with white on the red belly, and all the fins red except the dorsal, and even that partly so; the difference between these fishes, where colour is of so much importance, is easily discerned; added to which he represents the lateral line as being dotted with white; and the nostrils are not placed in a deep depression as in our fish. Mr. Yarrell also says that in the fish he describes the beginning of the dorsal is half way between the point of the nose and the adipose fin, which is far from the case in the Enniskillen Char; and he says further, that the pectoral is small, while in our fish the length of this fin is only a little less than from the snout to the border of the gill-cover. Compared with an example of the Melvyn Char of the length of ten inches and a half, the latter is of a stouter form, the head more sloping down, gape larger, fins larger, and the tail especially so; and while in the former the pectoral fin runs only a little beyond half way to the root of the ventrals, and the origin of the dorsal is above the point of its termination, in the last-named it runs more than two thirds of that distance. The dorsal fin of the Melvyn Char has twelve rays, the anal eleven, with sixty vertebræ, as contrasted with thirteen and twelve rays, and sixty-one vertebræ of the Enniskillen Char; in both cases their course being over the caudal plates, as in others of this family; and in the fish we have been describing, a large blood-vessel is distributed to the root of the tail; as perhaps might be noticed in other species if sought for. The flesh is pink, and these distinctions are the more deserving of notice, as both these fishes appear in many instances to inhabit the same lakes.

ALPINE CHAR.

Salmo alpinus,	Linnæus.
Salvelinus alpinus,	Nobis.

It is probable that Linnæus never definitely characterized this species as to be distinguished from others now known in his own country, as described by Nilsson; but it is probable that Artedi is correct when he refers it, as we have seen, to the *Salmo Lapponicus alpinus* of the M.S. of the Journey of Linnæus, which, under the title of *Lachesis lapponica,* has since been published in English by Sir James Smith, P. L. S. Nilsson describes four species of Chars as known in Scandinavia; and he refers to Mr. Yarrell's British Fishes as affording a satisfactory representation of this species; but in this respect we possess the superior advantage, through the kindness of Robert Embleton, Esq., of having the opportunity of deriving our figure and description from undoubted examples of this fish, from Loch Grannock, in the Highlands of Scotland; where or in which neighbourhood alone it has hitherto been found in the United Kingdom; and where, as well as even in Siberia, it inhabits places subject to a greater degree of cold than do others of this family. In Norway it has been observed to go up the course of rivers more freely than other Chars; and its range in that direction is higher than that of the Salmon, or indeed than any other fish; for it approaches within two thousand feet of the line of perpetual snow. Linnæus found them caught, together with Pikes, in a river in Lycksele, Lapland, by fishermen in the month of June. It is said to shed its spawn in September and October. In a review in the "Fisherman's Magazine," vol. i, of the Rev. Mr. Barnard's book, entitled "Sport in Norway," probably referring to this species, it is said that in



all the northern rivers the Char will take a fly greedily; and he remembers to have heard from a Norwegian fisherman that on one occasion he thus caught a Char in the open sea, some distance from the mouth of the river.

The example described, which was a female from Loch Grannock, was seven inches and a half in length; the shape plump, deep, the belly protuberant; forehead a little rounded; eye moderate; jaws equal, mystache extending to the hindmost border of the eye; small incurved teeth in it and the jaws, round the palate and on the tongue; in the latter widely separate, in two rows; none seen in the vomer. Nostrils about midway between the eye and the snout. Head flat between the eyes, with a slight ridge. Small scales on the body; lateral line straight, the pores obscure. The body becomes narrower towards the tail. Dorsal fin anterior to the middle of the length, with eleven rays, the first short, and two last from one root. Anal with eleven rays, the third longest; pectorals reach more than half the distance to the ventrals, ending pointed, with twelve rays; ventrals sharp, long, with nine rays; tail forked; hindmost rays of the anal opposite the adipose fin. The colour black on the back and sides, softening into whitish on the belly, with a patch of bright scarlet in front of the ventrals, which fins are not close together; the whole back and sides with scattered white spots; pectoral, ventral, and anal fins yellowish, the latter with a white border in front. This example was distended with enlarged roe, of which the right lobe was much larger than the left, so that the latter, together with the stomach and entrails, were thrust far upward. Air-bladder large. The aspect and proportions of this fish are visibly different from those of the other Chars. It is said to attain the length of ten inches, and as in all the Chars the males are adorned with more splendid colours than the females; the sides verging into blue or greyish brown, in the young with broad dark transverse streaks on the sides; the tail in adult fishes in this and the Torgoch with a broad white terminal border.

It is remarked by Nilsson that such of those fish as go up the stream the highest have their flesh reddest.

A question arises, whether does this Alpine Char really differ from the *Salmo carpio* of Linnæus, and of Fabricius in his "Fauna Greenlandica?" which in Greenland is said to be sometimes found at the mouths of rivers and in the sea. In that country it sheds its roe in August.

We have already remarked that although Chars are especially inhabitants of lakes, it is not every lake that will suit their nature and habits; but only such as are very deep, usually on elevated ground; or, as a compensation for this last particular, in some latitude towards the north, where the temperature is with a degree of steadiness which verges towards the sensibly cool or cold. In England these conditions are found in what is popularly termed the lake district; which comprises portions of Westmoreland, Cumberland, and part of Lancashire; where Windermere, Brassmere, Buttermere, and Coniston Water, together with Keswick and Cummon Water, are famous for some of these fishes. Dr. Davy informs us that he himself introduced them into Easedale, but with what success we have not heard.

In Wales the Torgoch is most abundant in Llyn Cwyllian, or Cwellyn, on the west side of Snowdon; but there are lakes in this neighbourhood in which this Char has never been met with. In Llanberris the abundance for which it was famous was once checked, in consequence of the flowing into it of water from a mine; so that it was supposed they were all destroyed; but they still exist there, as we know from having obtained them.

In Scotland besides Loch Grannock, in Kircudbrightshire, they are also known in Lochs Corr and Killin, in Inverness-shire, and also Loch Inch; and Sir William Jardine found them in Sutherlandshire. There was also a Char in Loch Leven, but whether so at present seems uncertain.

In Ireland all the species except the Alpine appear to be more widely distributed than in other parts of the United Kingdom. Mr. Thompson has specified the situations of these fish at considerable length in his natural history of his native country, and from him with other help I derive the following particulars, joined to those which have been given in our account of the individual species. The lakes or pieces of water that have been enumerated are Lough Melvyn, Esk, the Commeloughs and Stilloges in the mountains of Cummeragh; Lough Neagh, Eagish; Inchigcelagh, in the county of Cork; Kindun, Gartnan, Shassuck, Kindrum, Keel, in Donegal; Dan, in Wicklow; Lough Nabrak, Bofin, and a few others of smaller size in Galway; Lough Owel; and Lough Erne, in Fermanagh; but it is said that none have been obtained from Lough Eagish for several years, and it seems a remarkable circumstance in the history of these fishes, that while they appear to be by their ordinary habitation far beyond the reach of enemies and injury, they should be so liable to be lost from the depths they have so long frequented.

OSMERUS.

Form of the body lengthened, without spots. Two ranges of separated teeth in each palatine bone; only a few in front on the vomer. Eight rays in the gill membrane. The ventral fins opposite the anterior edge of the dorsal.

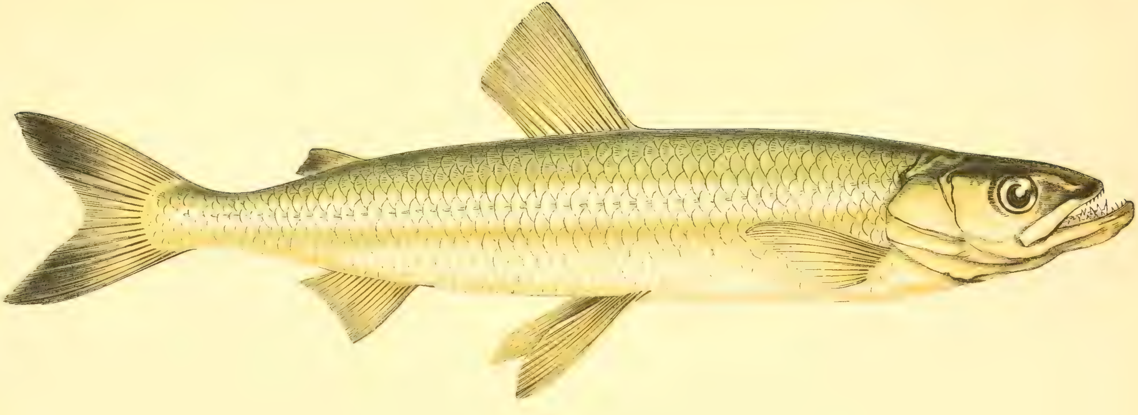
SMELT.

SPIRLING.

Smelt, Eperlanus Rondeletii,	Willoughby; p. 202, table N. 6.
Eperlanus,	Jonston.
Osmerus eperlanus,	Linnæus. Cuvier.
" "	Fleming; Br. Animals, p. 181.
" "	Jenyns; Manual, p. 429.
" "	Yarrell; Br. Fishes, vol. ii, p. 129.
Salmo eperlanus marinus,	Bloch; pl. 28. Donovan; pl. 48.

This fish should be distinguished from the Atherine, which in some parts of the kingdom bears the same name, and on a casual view might be mistaken for it; but, among other marks, the existence of an adipose fin on the back, in place of a larger second dorsal with rays, will readily distinguish them.

It has been supposed that the name of Smelt was given from a particular and agreeable odour that is perceptible when the fish is newly taken from the water; but the true meaning of the word is assigned by Jonston, and it is the same with that which is used to signify the melting of metals (smelting) from the mine, its derivation being from the appearance of transparency of the substances of this fish, as if it had a tendency to melt away. The French name, Eperlan, employed by Rondeletius, to which he gave a Latin termination, and from which perhaps we obtain our other English designation



CCXXVII

of Spirling, is also significant of its *pearly* appearance when first caught.

The species which we term the true Smelt is held in considerable reputation for the table; and in consequence of this in places which it frequents a fishery is carried on for taking it. Such is the case in the Severn, and also near the outlets of the larger rivers of our more eastward and northern coasts, where a particular size of the mesh for this purpose is rendered legal by a law of the time of Elizabeth; and four or five thousand of these fish have been brought to market from a single fishery in a week of the season, although a less number than this is now said to furnish the supply. In proportion to the size of the fish fashion has fixed the price at a high rate; and where it is recorded that formerly they might be bought at a penny each, or even from threepence to sixpence a score, they have since reached to three shillings, and above, for a dozen.

The Smelt is migratory, but the season of entering rivers has been variously stated. Thus it has been said that they come up the rivers about the end of August, and continue until about the middle of April, when they are accounted in their best condition; which is when they are about to shed their spawn, and that immediately after performing this function they return to the ocean. But it is remarked by Dr. Parnell, who observed the motions of these fish with much attention, that such as are about to shed their spawn do not enter rivers until about January, and "in the month of March they ascend the Forth in large shoals to deposit their spawn in fresh water; this they shed in immense quantity about two miles below Stirling Bridge, when at that time every stone, plank, and post appears to be covered with their yellowish ova." Unlike, therefore, the larger members of the Salmon family, these fish do not go far up the river to perform this duty; nor do they, like them, cover over the deposit, but, without concerning themselves further with what shall befal it, they hasten back to the sea, where they are soon lost sight of; for we believe they are not often taken far in the salt water either by nets or in the stomachs of fishes. But it is not long before the young are hatched, and their growth is speedy, so that by the decline of summer they have reached to three or four inches in length. In August, and afterwards, they abound, and they continue to pass upward and down with the tide, until their full-grown parents and predecessors are coming up again to breed, at which time they take their final departure. From the difference of season observed in their migrations by these smaller and larger examples, with some other variations of habit, and a degree of dissimilarity in form, it was once supposed that these old and younger fish were of different species, and as such they are spoken of by Jonston, as well as by Bloch, who has given a representation of both; but at this time no doubt remains of their being of one kind, and only in different stages of growth.

The Smelt is an inhabitant of the more northern portions of a temperate climate, and is common so far north as Sweden. In Scotland, and the east and west coasts of England it is abundant; but, as appears from Mr. Thompson, it is less so, and local, in Ireland, and none have been recognised along the shores of England from the Thames westward to the Land's End. On the north coast of Cornwall, as about St. Ives, a few have been taken, and Mr. Dillwyn mentions them as occurring at Swansea, although rarely, and we have noticed that there is an established fishery for Smelts in the Severn. I have been informed, on what appears to be competent authority, that they are not uncommon at Brest; and Duhamel says it is taken in abundance at the mouth of the Seine.

Mr. Yarrell refers to some trials which had been made to preserve these fish in ponds of fresh water, and we learn from Nilsson that such is their usual habit in the middle and north of Sweden; where they are found in lakes which have a sandy bottom throughout the year, except when they quit them for the purpose of shedding their spawn, which is early in April. It is then they leave the deeper water, and pass up in thousands to the shallower shores of rivers, where they are caught in multitudes. It is there observed that the schools of Smelts of larger and smaller size do not associate together; in which, however, they only follow the example of several other species of sociable fishes. The smaller Smelts are considered as good bait for the Pike.

The Smelt rarely exceeds nine or ten inches in length: the example described measured seven inches to the fork of the tail; the depth at the origin of the dorsal fin one inch and a fourth; the body compressed, slender, the line gently sloping from above the pectoral fin forward. Gape rather wide; under jaw protruded beyond the upper; mystache rather long; teeth in the jaws pointed, the largest in front of the vomer and on the tongue; in the present instance a very prominent one in front of the tongue. Eye rather large. Scales on the body rather large. Lateral line straight, about the middle of the body, in a bright white stripe from the gill-covers, and in two instances one higher than the other, ribmarks descending from it. First ray of the dorsal fin midway between the snout and end of the fleshy portion of the body. Adipose fin nearer the tail than the middle space from it to the dorsal; ventrals large; the caudal forked. Colour along the upper parts pea-green, with an appearance of transparency; below silvery; fins with pale tints of green. In one example the top of the head light brown, the fins and tail yellowish brown. The dorsal fin has ten or eleven rays, pectoral eleven or twelve, ventrals eight, anal sixteen, caudal nineteen.

THYMALLUS.

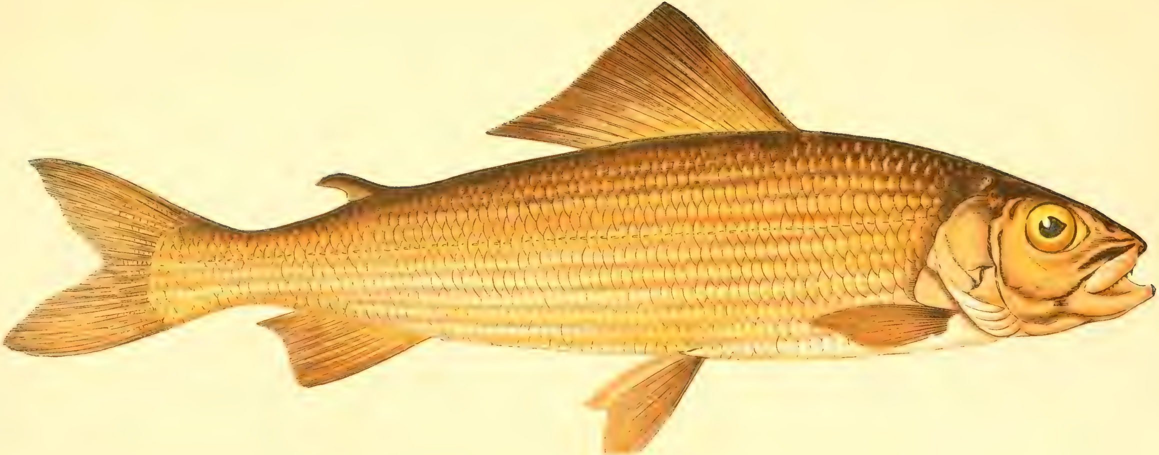
With the structure of the jaws like the Trouts, the mouth has a limited opening; teeth very fine. Scales on the body large. Dorsal fin rather long, wide. Seven or eight rays in the gill-membrane. The small square mouth, coupled with the high dorsal fin, will distinguish this genus.

GRAYLING.

Grayling,	Jonston; pl. 26, f. 3.
Thymallus, Umber,	Willoughby; p. 187, table N. 8.
Coregonus thymallus,	Linnæus. Bloch; pl. 24.
" "	Fleming; Br. Animals, p. 181.
Thymallus vulgaris,	Cuvier. Jenyns; Manual, p. 430.
" "	Yarrell; Br. Fishes, vol. ii, p. 136.

It is to be observed that Rondeletius makes the *Umbra fluviatilis* and *Thymus* to be different species; but what he says of either of them may apply to our Grayling, although his figure of the *Thymus* is represented too deep, unless, perhaps, when the fish is heavy with spawn. Gesner believes the Umbra to be our Grayling; but a fish of the same name mentioned by Columella belongs to the sea, and is our Sciæna or Maigre, of which the word Umbra is a translation.

It is not the least remarkable portion of the history of the Grayling, that its distribution among the rivers of our country is irregular as it is limited; so that while it is abundant in some places, especially in the north and east of England, in others, perhaps not far removed, and also in the south and west, it is unknown; nor has it been discovered in any part of Scotland and Ireland, although there are situations in these portions of the United Kingdom which appear to be equally well adapted to its habits. Circumstances of this nature have given rise to the supposition that the Grayling,



GRAYLING.

CCXXVIII

which is well known to be a delicate dish, and as such is spoken of in the "Book of St. Albans,"—"The Grayllynge, by another name callyd Umbre, is a delycyous fysshe to mannys mouthe,"—is not an original native of our rivers, but was at first imported from the continent, where it is more common than with us; and hence that it was conveyed only into such districts as suited the convenience of those who brought it. We cannot affirm or deny this, but it is certain that in no distant times some of our rivers have received it from others, as is the case with the River Test, in Hampshire, mentioned by Sir Humphrey Davy, to which it was brought from the Avon not a great while since; and they have increased in their new residences as freely as in their former stations, but from some peculiarities in their nature it is only in individual streams that the labour of conveyance is likely to be accompanied with success. It may be, however, that this may be caused by some known peculiarities in the structure of this fish, together with some of its appetites; in which it differs from the generality of the fishes of its family, and which demand a combination of circumstances not usually found in our rivers, but which will account for the fact that no Graylings are known in England west or south of the Avon, in Hampshire, or the branches of the Severn, in the higher or Welsh portions of which, where this fish is well known, it is little likely they should have been introduced from a distance.

The chosen stations of this fish are in swiftly-flowing but not turbulent rivers, where the water is usually clear, and always cool, but less than severely cold, with a clean and sandy or pebbly bottom; and while it does not urge its way upward so near the head as the Trout, and will not remain long in a shallow depth, it requires also a succession of deeper pools in softer ground, to which it may retire on a change of season, for it wanders less, and even hides itself from sight in winter. As regards some of its habits a comparison has been made between this fish and the Trout, on account of some degree of likeness that exists between them, but in which the contrast appears as great as the similarity. To some extent they feed on the same sorts of food; but the Minnow, which is a chosen bait for the latter, is rarely taken by the

Grayling; and even of flies, after which both are eager, the Trout pursues the larger kinds, while those sought for by the Grayling are of the very smallest, and a grasshopper is preferred to all besides. It swallows earth also, with mud and sand, together with the smaller shells; and as in some rivers there have been found grains of gold mingled with the sand, and such have been found in its stomach, it has been said that these particles of metal were selected by choice, and to them the fish was indebted for the brilliant yellow which sometimes adorns its body and fins. The station which this fish assumes while waiting for prey is usually about mid-water; or if nearer the bottom, not close to it, and not far from a rock or stone; and from such places it more readily rises than goes down, but it returns to the same resort when success has crowned the excursion: and here again we find a contrast to the habits of the Trout, for while the latter is watchful, rapid, and wary in its actions as it deals with temptations, the Grayling,

> Unabashed, will dare,
> Baulked e'er so oft, the disappointing snare,
> Simple and bold:

and hence it is that to the angler

> The Grayling yields no fame; too easy prey
> He turns his side of gold-bespangled grey.
>
> ANGLERS, a Poem.

In its own sphere, however, the Grayling is capable of very swift motion, as is represented by Ausonius in its ancient name of Umbra:—

> Effugiens oculos celeri levis Umbra natatu.
>
> The smooth-scaled Umbra as it passes by,
> Flits as a *shadow* o'er the gazer's eye.

Continuing the comparison of this fish with the Trout, Sir Humphrey Davy remarks that the latter in all its habits of migration runs upward, seeking the fresh and cool waters of mountain sources to spawn in; the Grayling, he believes, has never the same habit of running up the stream. He never saw one leaping at a fall, where Trout are so often seen; and we add that the difference of habit which is associated with its power of rising and falling in the water, and its want of power to spring aloft are clearly connected with the expansion of its wide dorsal fin, and also with the comparative structure or arrangement of the bones of the tail, so characteristic in general of the fishes of this extensive family; as in them the line of the vertebræ is directed upward, so that the setting on of the larger number of the bones and their rays is on their lower side, as we have described in the proper genus *Salmo;* but these connecting bones are in this instance slight and feeble, and ill adapted to a strenuous leap; but the rays of the upper lobe of the tail are connected with the termination of these vertebræ, and not the side, without the intervention of a plate as in most fishes; and those of the lower lobe are attached to the vertebræ anterior to the place where they are turned upward, the middle rays of this organ being united to bones which are too slender to be termed plates, although they are a little wider than what we may properly term rays; which structure is sufficient for what will act in progression, even of a rapid kind, but not for the stronger effort of leaping.

This fish is reported to be scattered over Europe, and some portion of Asia, and from the high north of Lapland, Norway, and Sweden, through Germany and Hungary to France, even to the more southern parts, with Switzerland and the north of Italy; but in these latter countries they are only met with in the cooler departments, where the streams are at rather high elevations, although not near glaciers, and a heat much above fifty degrees is as fatal to them as severe cold. It is said also they inhabit the Caspian Sea, and are found in the Baltic, from whence they proceed up through the course of the rivers to deposit their spawn; but on trial it was found by Sir Humphrey Davy that with us even brackish water was fatal to them. And indeed so different are the habits of the Grayling as described by Nilsson, (and which we will presently give from him) from those of our own country, that we are disposed to believe with Sir Humphrey Davy, that this northern fish is a different species.

With us the time of spawning is about April, and the roe is cast on stones and gravel without being buried below the surface, as is the case with that of many fishes of this family.

This condition of exposure might seem to lay open the treasure to the depredations of a multitude of devourers; but observers have affirmed that at this time other fishes have left that neighbourhood, and it is possible that the Graylings, with their numbers, may have driven them away, as we know is the case with at least some assemblages of sea-fishes; which, without any obvious reason or influence, and as it appears solely by their presence, have expelled from a neighbourhood others not less individually strong. In the act of shedding the roe a female is attended with two or three males; and the eggs are not long in passing through the changes of development, so that Sir H. Davy remarks, about the end of July or beginning of August the young fishes are four or five inches long, and "sport merrily at a fly." Their growth after this is also speedy, so that about October they have attained to more than half the size they ever reach.

According to Nilsson, the Grayling, which is one of the commonest of the Scandinavian fishes, is met with in the North Sea, Cattegat, and Baltic, from which they come up into most of the rivers and lakes; and in Lapland they are taken in the high fell lakes, even so large as to weigh eight or nine pounds; a bulk which of itself is sufficient to raise a doubt of its being the same species with our own. In the Baltic they commonly weigh about two pounds, with a length of eighteen inches; which form the usual dimensions of an English fish. Some of these Swedish fishes remain all the year in fresh water, and some also are found in the Baltic at all seasons; (from which it would appear that they do not all spawn at the ordinary period;) which in that county is somewhat various, and ranges from the middle of October to the middle of December; after which they return to deeper water for the winter. In the spring they pass up the rivers in schools, at the time when the leaves are shooting out.

Uniform testimony is borne to the excellency of this fish for the table; and it is therefore fished for by those who consider the exercise as most successful when a large supply is obtained; and when a net is employed this is sometimes in great abundance. It is valued most highly in October and November, but is not long out of season, and therefore where it is met with it is always welcome.

With us an example of this fish that weighs three or four pounds will be thought of very unusual size; but the specimen described was no more than eight inches and a half in length to the fork of the tail, with a depth of one inch and three urths at the dorsal fin; the sides moderately compressed; head wide, slightly rounded over the top; eye rather large, the pupil pear-shaped, the point directed forward. Nostrils above the level of a line from the eye to the lips, and almost on a level with the forehead; a hollow between the eyes forward. The gape small, lips tender, so that a hook may break through them easily; the mystache broad, short, with some teeth on its border; teeth scarcely perceptible in the jaws; none on the palate or tongue; a slight veil in front of the mouth. The body rises from the nape gently to the dorsal fin; which fin is broad and high, three inches from the snout, with twenty-one or two rays, the two last from one root. Scales large; lateral line straight, with eighty-four pores; the body more slender towards the tail. Pectoral fin narrower near the end; tail gently forked; ventrals with ten rays and a small wing; the anal begins under the adipose fin. The general colour yellowish brown, including the fins; several deeper brown lines along the body, with a zigzag edge formed by the union of the upper and lower portion of the scales; under the belly white. Some smaller examples were of a lighter colour, with the lines along the body well marked; but this fish is liable to much difference in the colour in different streams, at different stages of growth, and especially when in its highest season of health. Thus it is described as of a fine golden yellow on the body and fins; sometimes with golden spots, and very dark, almost black on the back.

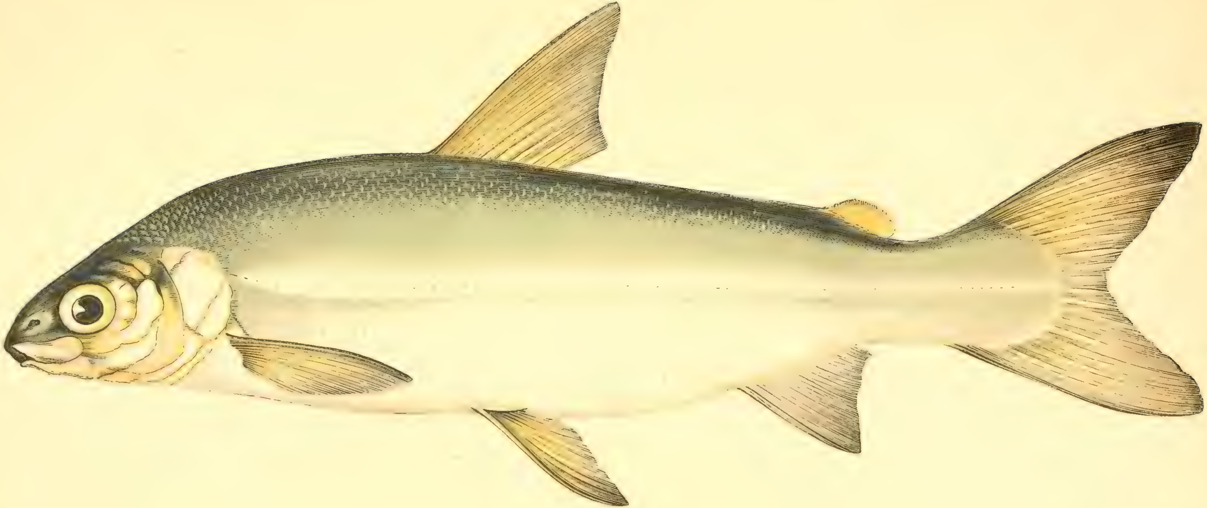
The smell of this fish when newly caught has been much taken notice of, and is said to be like that of the plant Thyme; from which therefore it has obtained its Latin specific name; but this smell soon leaves it, and the fish should be in the hands of the cook within a few hours after it is taken. The air-bladder is of flimsy texture. Sir H. Davy says its stomach is very thick, not unlike that of a Char or Gillaroo Trout. It may be added that Nilsson mentions of the teeth, a single row on the jaw-bones and front of the palatines, and a few in front of the vomer.

GUINIAD.

Guiniad,	Willoughby; p. 183.
Salmo Wartmanni,	Bloch; Pl. 105.
Coregonus Wartmanni,	Cuvier.
" *Pennantii,*	Cat. Br. Museum, 1850, p. 80.
" *Lavaretus,*	Linnæus. Fleming; p. 182.
" "	Jenyns; Manual, p. 431.
" "	Yarrell; Br. Fishes, vol. ii, p. 142.
Coregonus Nilssoni, formerly C. fera,	Nilsson.

We have several times found occasion to refer to the large amount of confusion produced, especially among fishes of the Salmon family, by the great variety of names which have been applied to each species; or, what is still worse, by the same name being applied to several species. Similar to this is the case of the Guiniad, in regard to which, and some others that are like it, we cannot feel assured in reference to the synonyms derived from foreign writers; although in one instance, which was an example obtained from Sweden, we entertain no doubt of its being the same with the British species; of which the name as given above professes a meaning in the ancient language of our country, and which continues to be spoken in Wales. It designates a fish which is distinguished by the brilliant whiteness of its colour; but like all names which are simply descriptive, this has also been applied to other species in that country; and especially to the Sewen, and also to a younger condition of the Common Salmon; from all of which however the real Guiniad may be easily distinguished.

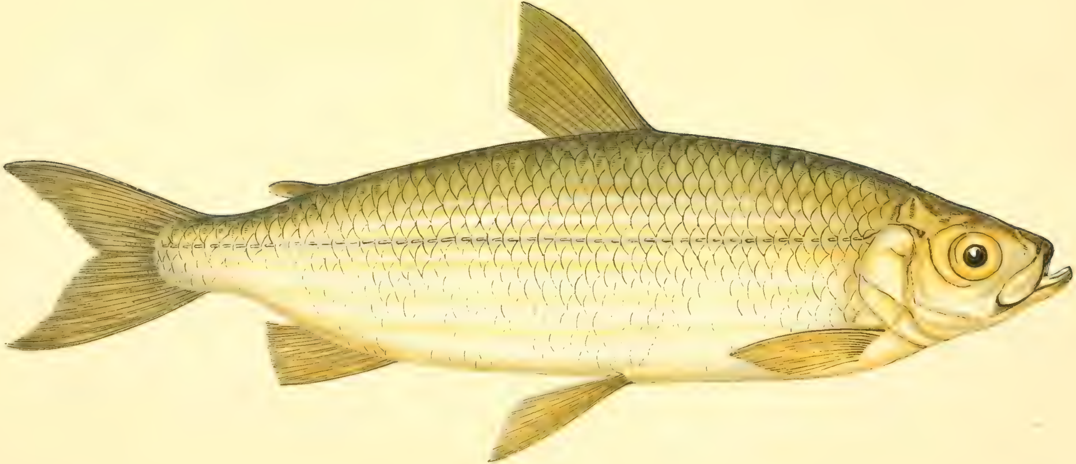
The Guiniad is known over a large portion of the alpine or elevated districts of the continent of Europe; but in our own country in comparing its distribution with that of the Grayling we find the former even more limited than the latter; while



like it also in situations where it exists, it is sometimes met with in large numbers. This is particularly the case in Wales, and also in Cumberland; but they belong to lakes rather than rivers, and as they are at times found assembled in schools, and thus collected, come near the shore in spring and summer, they provide a welcome feast for the people of the neighbourhood; for although not valued as a delicacy for the epicure, they are relished by those whose sauce is a good appetite. Pennant reports, on the authority of a friend, that between seven and eight thousand have been taken with a net at a single draught. He adds that the flesh is insipid, and soon spoils, but that it is usual to preserve them with salt, and also that they die very soon after being taken.

These fish spawn in the winter, but no particular account has been given of the proceeding, and the fish itself has been little noticed by anglers; so that the patriarch of the art, who probably never saw an example, is content to copy what he says of it from Cambden, who mentions it only as a little-known rarity. He says, "The River Dee, which runs by Chester, springs in Merionethshire, and as it runs towards Chester it runs through Pemble Mere, which is a large water; and it is observed that though the River Dee abounds with Salmon, and Pemble Mere with Guiniad, yet there is never any Salmon caught in the mere, nor a Guiniad in the river." It is also said to be taken in Coningston Mere, in Lancashire; but of all its known resorts, the above-named Welsh lake, which is also termed Bala, Llyn Tegid, and Pimbee Mere possesses it in the greatest abundance; and I feel indebted to the kindness of Sir W. W. Wynn, Bart., for the opportunity of procuring specimens from which our figure and description were taken. It has been reported as having been found in Ireland, where, however, it is not mentioned by Mr. Thompson, of Belfast; and it is to be doubted whether the so-called Fresh-water Herring, or Pollan, has not been mistaken for it.

The example described was twelve inches in length, and wo inches and three fourths deep in front of the dorsal fin, from which part it first slopes gradually, and then more rapidly to the snout, which overhangs the mouth; the slope from the snout to the mouth square; gape small; lower jaw short, slightly turned up at the symphysis, as in the Mullets, this jaw being received into the upper; no teeth, except a few fine ones on the tongue. Nostrils in a depression midway between the eyes and snout. Body compressed, more flattened behind the dorsal than in front of it, narrower behind the adipose fin and anal, which fins approximate to the tail; lateral line straight. The (first) dorsal rises five inches from the snout, its front margin a little anterior to the ventrals, the first rays high, thirteen in all; pectorals long and pointed, eighteen rays; ventrals wide, with thirteen rays, and a very short one; a scale at its root the breadth of the root; the ventral wing short; (scales of the body of moderate size.) Anal fin with thirteen rays, and a very short one; twenty-three rays in the tail. Colour above dark, with a tint of blue; cheeks, sides, and below silvery white; fins a neutral tint. The eye is large, and the mystache is gently curved, reaching back to the front of the eye.



VENDACE.

CCXXX

VENDACE.

The VANDOISE of Duhamel appears to be the Dace.

Coregonus Willoughbii,	YARRELL; Br. Fishes, vol. ii, p. 146.
" *marœnula,*	JENYNS; Manual, p. 433.
Vendace,	DR. KNOX in Zoologist, 1855, p. 4710.
Salmo marœnula,	BLOCH; pl. 28, f. 3? and if so, Nilsson refers it to *Coregonus albula* of Linnæus.

THE Vendace is a small fish which in Britain is believed to be peculiar to Lochmaben and the neighbouring pieces of water, in Scotland, and into which, on account of its supposed superior delicacy for the table it is reported to have been conveyed from abroad at the suggestion of the unfortunate Queen Mary; but by Sir William Jardine, Bart., who first decided that it was a distinct species, this is thought to be unlikely, and from whence it was imported there appears to be no traditionary remembrance. But if the above account be correct, no small amount of care and skill must have been exercised in the conveyance, since the living fish will scarcely bear exposure, at least for the requisite length of time; and therefore it must have been the roe that was transported, and the fish is exceedingly prolific, so that they exist in large numbers within their limited district, in spite of the depredations committed on them by the voracious fishes which are found in the same lakes. They swim with great activity in considerable schools, and sometimes with a remarkable separation of the sexes; and Dr. Knox, who studied the habits of this species with close attention, on dissection discovered that out of forty individuals taken at one time only two were males, and on another occasion, at the middle of December, of twenty-four examples two only were males. They are said to shed their spawn in November, but it is certain that this is not always accomplished until the end of the year, for Dr. Knox discovered in several which he took in December, that while in the larger number the ovaries were small, and, as we may suppose, had lately discharged their contents, there were two in which the grains were of large size, as if ready to be shed. At some seasons it is certain that the sexes associate together in one company, for on another occasion, in the month of October, of fifteen that were examined nine only were females.—("Zoologist," June, 1855.)

It appears that the Vendace is so far of a delicate constitution that it can exist only in a cold or cool temperature, and Nilsson says that it inhabits most of the rivers and lakes in the middle and north of Sweden. In our own country it is noticed that however active, and even sportive, at other times, in the heat of summer they seek shelter in the deeper water. The food of this fish was long a matter of uncertainty, and in its own neighbourhood it was even supposed to be supported by no solid material. It has never been taken with a hook; but we owe it to Dr. Knox and Mr. Yarrell that we are now informed of the nature of their food, which is the several species of *Entomostraca* which abound in these waters. The usual method of taking this fish is with a sweep-net, which is for the most part used about July, although, as we have seen, these fish may be taken late in the season; and the occasion of employing this net is often formed into a festive assembling of the neighbouring gentlemen.

An example of this fish which I have the pleasure to possess, was supplied by the kind attention of the Earl of Enniskillen, and I have reason to believe that it is the same which is referred to by Mr. Thompson, in his "Nat. Hist. of Ireland," as having been obtained from Sir W. Jardine, Bart. It is in length to the fork of the tail five inches and three fourths, which is about the usual size; but Dr. Knox has seen it nine inches long.

Besides a skin of this fish with which I was favoured from the Earl of Enniskillen, and which was once in the possession of Mr. Thompson, I have also been supplied with examples by the kindness of Robert Embleton, Esq., from which our figure and description have been taken. In length the example described was six inches and a fourth, which is about the usual dimensions; depth in front of the dorsal fin one inch and five eighths, the outline rising from the front to the first ray of that fin. The body compressed, covered with scales of moderate size, not easily lost; under jaw projecting; mystache broad, slightly bent, reaching half way to the eye; gape very moveable. Eye large and prominent. Teeth none in the jaws, minute on the tongue. Dorsal fin opposite the ventrals, with eleven rays, as has also the anal, the two last from one root. Pectorals free of the gill-covers, reaching a little more than half way to the ventrals, with fourteen rays; in the ventrals ten rays; adipose fin opposite the termination of the anal, and consequently not far from the tail. Tail broadly forked, with twenty rays. Colour of the back brown, the sides tinged with yellow; above the hindmost part of the eye golden; faint lines of yellow along the sides, but over the whole and on the cheeks a brilliant white. Mr. Yarrell says that the dorsal fin and upper portion of the sides were a fine green, which may have vanished from my examples; pectoral and ventral fins yellow. There are about sixty-eight pores along the lateral line. The figure of this fish as given by Mr. Yarrell, as compared with three examples, is too slender

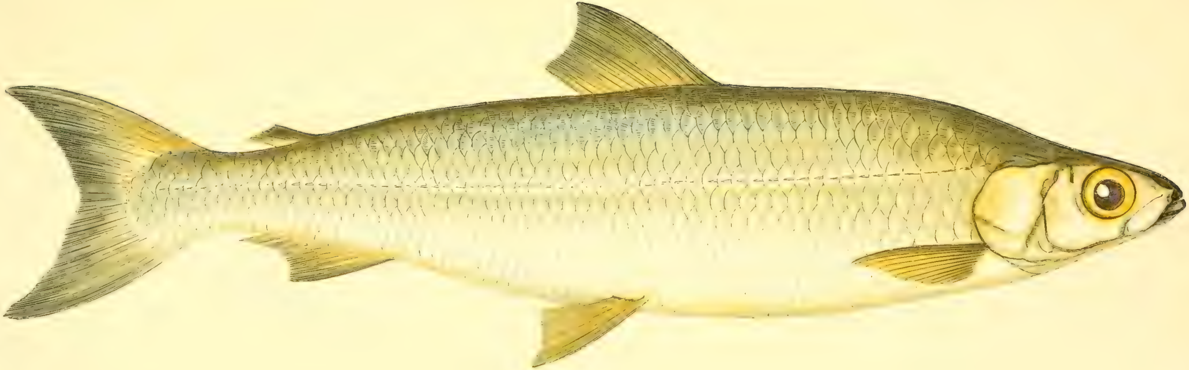
POLLAN.

FRESH-WATER HERRING.

Coregonus pollan,	Thompson; Natural History of Ireland, vol. iv, p. 168.
Powan,	Yarrell; Br. Fishes, vol. ii, p. 151.
"	Jenyns; Manual, p. 422.

This fish affords one of the many examples in which the common name in one district is unknown in another at no great distance, but where the same species bears what might appear even a more characteristic designation; and yet which it shares with some other fish of even a different genus. It was from this cause that an attempt to obtain examples of the Pollan in Ireland was met with the reply that no fish was known by that name, although on further search at the same place it was discovered that the Fresh-water Herring was familiarly known to everyone, although even this name was applied to more than one species. And truly the latter designation is well applied to the fish we now treat of, and more appropriately than to any kind of Chars, so far as a cursory appearance goes; for, setting aside the small adipose fin, the likeness of the Pollan to the Herring in shape and colour is such as well to entitle the former to the epithet of *clupenoides*, which it might well bear.

It resembles the Herring also in being gregarious, and when they assemble it is often in large numbers, at which time they are fished for with a sweep-net, and thus they furnish a good supply of food for the public, the price not being a hindrance even to the poor. Mr. Thompson informs us that on some unusual occasions upwards of seventeen thousand have been taken at three or four draughts of a net in one day, and they

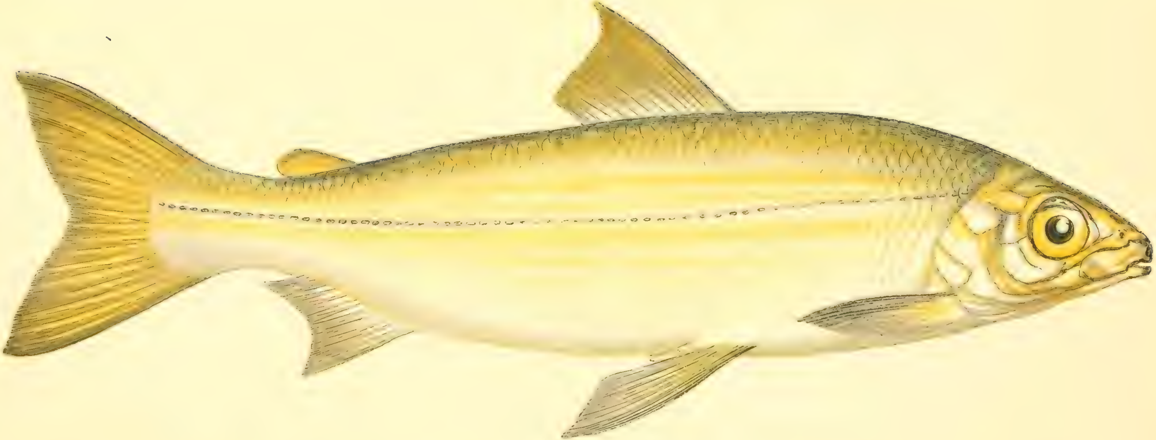


have been sold at three or four shillings the hundred. In the spring and summer they are in abundance in their particular districts of the places they frequent; but the largest numbers are in November and December, at which season they are preparing to spawn, and this function is performed on the hard or rocky bottom of the lake. On the comparison of many examples it has been found that the female exceeds the male in size.

This fish is strictly an inhabitant of fresh water, and although in some rare instances a few have been taken in rivers, to which they may have wandered, or into which they may have been driven by currents, yet their more usual and natural resort is in the large lakes of Ireland; for the Pollan has not hitherto been found in any other portion of the British Islands, to which, however, it might be introduced with some advantage. Of distant countries we can only venture to suppose that it is a native of Sweden. It is in Lough Neah, among the Irish lakes, that it is met with in the greatest abundance; and yet it is not equally numerous in every part, for Mr. Thompson found it to approach the borders only in certain districts, while in others that seemed equally fitted for it a few only might be seen. It is common also, but in less comparative numbers, in the Loughs Erne, Derg, and Corrib.

As this fish not only dies immediately on being taken from the water, but also soon loses its best flavour and fitness for the table, there is little doubt it might be salted or potted with advantage; but this does not appear to have been thought of, even when there is a glut of them in the market. They are not usually taken with a bait, although they will sometimes rise to a fly; and small shell-fish, together with *Entomostraca*, have been found in their stomach.

This fish has not been known to exceed twelve or thirteen inches in length, and the example selected for description measured nine inches, which is the more usual size. The body moderately lengthened, compressed, the proportions much as in the Herring; the head flattened above and behind the eyes, narrowest and sinking at the nostrils; jaws equal, the upper lip wide across, and sloping down to the mouth; mystache wide and thin; teeth in the jaws few, very slight, not easily discovered, none in the palate; a circuit of fine teeth on the tongue; front of the tongue contracted and lengthened. Eyes lateral, large. Body covered with scales. Lateral line slightly sinking at first, then straight. First dorsal fin behind the centre of gravity, with about fourteen rays; adipose fin posteriorly; tail forked, the rays twenty-three; anal with twelve, the first ray more than twice the length of the last. Vent far behind; ventral fins large, and twelve rays counted;(?) pectorals sixteen. Colour on the back dark bluish, pale yellow on the gill-covers, brilliant white on the sides and belly; iris yellow, with an orange border. The pectoral fin in this example measured an inch and one eighth.



POWAN.

[illegible]

POWAN.

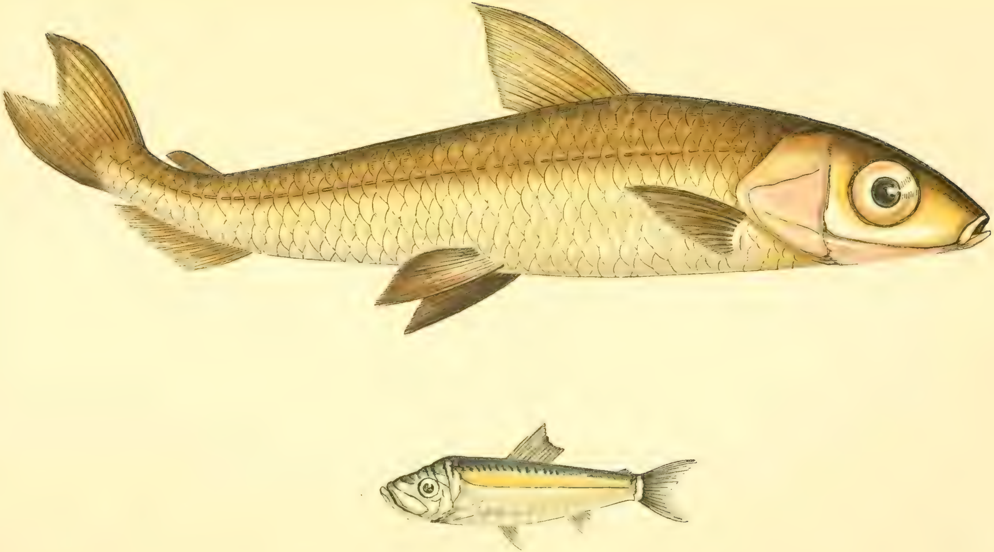
Coregonus Lacepedii, YARRELL; Br. Fishes, vol. ii, p. 151.

THIS is one of the three fishes which have passed under the denomination of Fresh-water Herrings, from a supposed general resemblance to the well-known fish of the ocean; as the Pollan, already described, and the Char of Lake Melvyn are the others. By this name and that of Powan it appears to have been long known as a distinct species to the people living near the lake Lochlomond, in Scotland; but among men of science it appears to have been first described by the French naturalist Lacepede; whose name was attached to it by Dr. Parnell; from whose observations we obtain the most particular account of what is known of its habits. There does not exist any difficulty in distinguishing this fish from others with which it may have been confounded, as will appear from the description we are able to supply; and which, together with the figure of it, have been taken from an example, for the possession of which we have the pleasure of acknowledging our obligation to the kindness of Robert Embleton, Esq., of Chat Hill, in Northumberland; to whom also I shall have great pleasure in offering a like acknowledgment in reference to other kinds of the fresh-water fishes of the remoter parts northward of the united kingdom.

Dr. Parnell says, "These fish are found in Lochlomond in great numbers. They are caught from the month of March until September with large drag-nets, and occasional instances have occurred in which a few have been taken with a small artificial fly: a minnow or bait they have never been known to touch. Early in the morning and late in the evening large shoals of them are observed approaching the shore in search of food, and rippling the surface of the water with their fins as they proceed. In this respect they resemble in their habits the Vendace of Lochmaben and the Salt-water Herring. They are never seen under any circumstances in the middle of the day. From the estimation these fish are held in by the neighbouring inhabitants they are seldom sent far before they meet with a ready sale, and are entirely unknown in the markets of Glasgow. In the months of August and September they are in the best condition for the table; when they are considered well flavoured, wholesome and delicate food. They shed their spawn in October to December, and remain out of condition until March."

Their ordinary food appears to be of the insect class.

Length of the example to the fork of the tail eight inches and a fourth; the shape plump; head rather small, rising towards the back; the mouth small, snout blunt, deep from its front to the jaw, the front resembling a small nose. Mystache attached far forward, contracted near its origin, and then wide, reaching to the anterior margin of the eye. Nostrils nearer the snout than to the eye. Eye large, and on its anterior border a membrane like a nictitating membrane. Head wide across and a little arched; gill-covers in several divisions. Body covered with brilliant silvery scales; lateral line with about seventy-five pores. The dorsal fin has thirteen rays, the first short, anterior to the line of the ventrals, the two last together; anal fin with fourteen rays, the first very small, before the line of the adipose, its last rays short, two together; the pectoral rises close under the edge of the gill-cover, ending pointed, reaching a little longer than half way to the ventrals, the rays fourteen; ventrals eleven rays, wide; adipose fin unusually wide for so small a fish; tail lunate, the lobes wide. Colour of the head brown, with gold-coloured borders and patches; cheeks silvery, as are the sides and belly. Blueness of the sides and black spots on the borders of the scales, as described by Dr. Parnell, appeared only when the fish had been removed from the preserving fluid and was become dry.



1. HEBRIDAL SMELT. . ARGENTINE.

CCXXXIII

ARGENTINA.

The mouth small, depressed at the angle; jaws without teeth; strong hooked teeth on the tongue, and a transverse row of small teeth in front of the vomer. Six rays in the gill membrane. Dorsal fin before the ventrals. The adipose fin in one species is so small as sometimes to have escaped observation.

HEBRIDAL SMELT.

Osmerus Hebridicus, Hebridal Smelt,	Yarrell; Br. Fishes, vol. ii, p. 133.
" " " "	Bloch; by Schneider, pl. 81, *Salmo silus.*
Argentina silus junior,	Nilsson.

This fish was first recognised as British by Mr. Yarrell, who believed it to be undescribed when he received it from Mr. Euing, by whom it was obtained from a fisherman in the Isle of Bute, where it had been long known, although not often taken. Mr. Yarrell judged it to belong to the genus *Osmerus*, with the characters of which, however, it did not exactly agree, from the position of the dorsal fin, which is situated in advance of the ventrals, and also in the extent of its gape. But this doubt in the classification of fishes closely allied to each other is the more to be excused, as Cuvier, in his "Animal Kingdom," had thought fit to place it in the genus *Coregonus*, from whence it has been removed by his coadjutor Valenciennes into that of *Argentina*, with the name of *A. Yarrellii;* and its place in this genus at least is countenanced by the authority of Nilsson, in his "History of Scandinavian Fishes," whose authority is the more to be regarded, since this species is well known to him as being a native of the German Ocean. It appears to have been called

Salmo silus by Ascanius, to whose writings, however, I have not access; but it appears that even by writers who must have known this fish it has been confounded with another which is like it, as by some it has been called *Argentina Sphyræna,* this latter being a fish of the Mediterranean; and Nilsson describes two closely-allied fishes of the north, one of which he designates *A. silus,* and the other, which is our Hebridal Smelt, he calls *Argentina silus junior.* But further, as a proof that these two fishes are distinct, he specifies the number of vertebræ in each, those of the larger species (or *A. silus*) being sixty-five, while those in our fish are only fifty-two; a difference too great to be ascribed to a casual variation in the number, or an error in the counting.

It appears that this fish is not rare in the sea near the islands to the north of Scotland, and along the coasts of Norway; and yet I am informed by Mr. John Iverach, of Kirkwall, in Orkney, that it is not known to the fishermen of that island; and but little seems to be known of its habit of going up into fresh water. Its being taken with a baited hook is proof of its eagerness for food.

To assist observers in further inquiry as to the habits of this fish, we have copied the figure given of it by Bloch, as above quoted; and our description is taken in a great measure from that supplied by Mr. Yarrell. The ordinary size of this fish appears to be seven or eight inches in length, while that of *A. silus,* referred to above, is said by Nilsson to be seventeen inches, the general form being much like that of the Smelt. Jaws nearly equal; gape small; teeth as described in the generic character; eye very large; upper surface of the head flattened, descending to the snout with a rapid slope. The body covered with large scales, which are easily lost; the lateral line rather high on the side, and below this line are two rows of silvery white scales, which run the length of the body. Nilsson says that in the large species when young the sides are silvery, but when full grown they become yellow. The dorsal fin in our fish begins half way between the point of the nose and the anterior edge of the adipose fin, and the longest ray nearly twice the length of the base of the fin; the adipose fin very near the tail; the tail itself deeply forked. The pectoral fin reaches to the plane of the commencement of the dorsal; the last ray of the anal fin opposite the posterior edge of the adipose fin. Colour of the body and fins, except the bright line above mentioned, a dull amber, gill-covers silvery. The dorsal fin has eleven rays; pectoral fourteen; ventral twelve, with the usual appendix or wing; anal twelve; the caudal nineteen.

THE LITTLE SILVER-SPOTS.

A little fish first made known by Pennant with the name of Sheppy Argentine, is the only British species that has with certainty been recognised, of a rather numerous family, which in some of its characters shews an affinity to the Salmon tribe; but in others it is sufficiently separated from it as to have led observers to place them in a distinct family. They resemble the Salmon in having the mystache or maxillary bones separate, with teeth along the border; but all the teeth are very small, and the less to be observed as the fishes themselves are of very small size. They are also marked with an adipose fin on the back at some distance in front of the tail, but this is of small size, so that by the first describer and other observers its existence was not noticed; which circumstance is the more easily to be explained, as under ordinary circumstances the fish itself may so far become mutilated that so small an organ cannot be discerned. It appears also, from my own observation, as of some others, that on very close examination there have been detected some minute rays in this fin; which circumstance removes it still further from the family of the Salmon; in which latter what is termed the adipose fin is rather an organ of sensation than of action. In their usual appearance also the fishes of this section are but distantly allied to the larger fishes near which they have been classed; but there is a curious conformation that belongs to them, of which the use is not evident, but which may be considered a distinguishing character of the class; and which consists of a regular arrangement of round and shining dots along the lower border of the body, from the opening of the gills to the tail; and which do not possess the nature of scales. Indeed, in what is to be regarded as a separate genus, there are no scales on the body, and in no case dots or organs overlap each other This family consists of abdominal fishes.

MAUROLICUS.

Of the fishes of the family which we have denominated Silver-Spots, there is only known in the British catalogue a species which is arranged by Dr. Gunther in the genus here specified, and of which the character is—the head and body compressed, and covered with a silver pigment, without scales; a row of shining spots along the side of the head and body, on each side of the lower border, to the tail. Gape wide, opening downward; mystache wide and long, with teeth on the edge, as also in the jaws; dorsal fin behind the middle of the body, but before the line of the anal; tail forked.

ARGENTINE.

Sheppy Argentine,	Pennant.
Scopelus Pennantii,	Cuvier.
" *borealis,*	Nilsson. Yarrell; Br. Fishes, vol. ii, p. 164 and 167.
" "	Dr. W. B. Clarke; Charlesworth's Mag. Nat. Hist., vol. ii, p. 22.
Maurolicus borealis,	Gunther; Cat. Br. Museum, vol. v, p. 389.

There appears to be some ground for the doubt whether all the examples, now become numerous, which have been found on the British coasts are of one species, or even of one genus, as they are now arranged; and this doubt becomes the more warranted when we find that no less than eight of these fishes, not very much unlike each other in size and shape, are said to be natives of the Mediterranean and the neighbouring ocean, or in the north, any one of which might be mistaken for another by a casual observer; and so much the rather since the more distinctive characters are liable to be mutilated or overlooked. Pennant's first account describes this fish by copying from Willoughby what the latter had written of a different species; and it is so much the more worthless as both these writers were mistaken in what they have represented; the last-named author having overlooked the adipose fin of his *Argentina,* and the former, probably misled by the name, by having guessed it to be a fish to which Willoughby's description will not apply. The figure given by Pennant was obtained from a different example from his first notice, but the name which he originally applied to it has been suffered to remain.

Mr. Yarrell was at first content to copy Pennant's figure, but in his second edition he has added others, in which the extent of the fins at least, and especially the anal, do not shew exact similarity; and as the likeness which I produce, although with some imperfection, and Mr. Edward's description, presently to be referred to, are not in all respects similar to either of them, the doubt still remains whether more than one species may not have been obtained in Britain. But leaving this to be decided by future inquiry, it further appears that this fish is far from being so scarce as was formerly supposed, at least within its own particular range. Low mentions it as found in Orkney, Mr. Peach obtained it at Wick, and Mr. T. Edward at Banff. At Redcar forty examples were obtained in the months of January and March, and others since. It has been obtained in Ireland, and five examples were procured by Mr. E. T. Higgins at Weston, on the north coast of Somersetshire, where they were taken in nets set for shrimps; and it is from one of these our figure and description have been taken. The example was, indeed, somewhat injured, and in consequence it is not offered as altogether a perfect representation; but it is judged better to give a resemblance of an original specimen than a mere copy, the more especially as our example was perfect in those particulars, from imperfection in which, as regards others, the principal doubts have sprung; to which we add that the highest amount of accuracy in description will be secured, by bringing together our description and those of Dr. W. B. Clarke in the "Magazine of Natural History," already referred to, and another by that indefatigable inquirer Mr. Thomas Edward, of Banff, as contained in the "Zoologist" for 1863.

This species appears to be limited to the northern portion of the Atlantic, and no instance is recorded of its having been seen on the shores of Devonshire and Cornwall, where we may suppose it would have been known if it had been the same with a species nearly resembling it, inhabiting the Mediterranean, and presently to be noticed. Nilsson mentions it as met with on the coasts of Scandinavia; but nowhere do we hear of it as seen in the open sea; but the larger number of examples discovered on our shores have been thrown on the beach in stormy weather, killed with the cold, or entangled in sea-weed. It has been supposed that they come near our coasts only or chiefly in the colder months, but those which were obtained in Somersetshire were taken in July.

The example described, and from which our figure was taken, in length measured an inch and three fourths, and half an inch at its greatest depth, which was not far behind the head. The body compressed; mouth deeply cleft, descending; under jaw protruding. The head slopes from behind the eye to the mouth. Eye large, high on the cheek. Behind the vent the body tapers to the tail. Body and cheeks glistening like silver; hindmost gill-cover narrow. Dorsal fin above the interval between the ventrals; but the rays could not be counted in any fin except the anal, where there were seven; the second dorsal or adipose fin was too obscure to have been discovered if not directed to it by description, but on close observation two or three rays were seen in it; pectoral fins low, close under the gill-covers; ventrals long and narrow; tail forked. A few bright and round silvery dots on the gill-covers, a double row of them along the border of the belly from the throat to the vent, twelve in number; another double row from the vent to the beginning of the anal fin, ending where is a single dot higher on the side; another double row of twenty-four smaller dots near each other running from thence to the tail. The lateral line first descends, and then runs straight to the caudal fin. Colour of the back dark bluish, blue tints on the belly; and it was observed that when these examples were taken from the water, the bright dots along the belly bore a reflection of pale green.

Dr. Clarke's example measured almost two inches in length, and from his figure the shape was proportionally much more lengthened than that we have described; the dorsal fin further behind; anal fin much more lengthened, the first rays longer than the others; adipose more distant from the tail; ventrals and anal closer together. He counts the fin rays—of the dorsal nine, pectoral seventeen, ventral eight, anal twenty, where Mr. Yarrell makes them fifteen; the tail eighteen. Of the number of characteristic dots, between the hyoid bone and pectoral fin five; the upper row on the belly from the pectoral fin to the spot over the ventrals nine; on the lower line of the belly, from a spot perpendicularly beneath the hindmost border of the eye to the base of the ventrals twelve; and from thence to the anal six, of which the two first are directed downward and backward; the four hindmost forming an arch from a little above the second to the commencement of the anal fin. One large one, in a line with the upper row of the belly, is placed slightly before, but above the commencement of the anal fin. Between the beginning of the anal and base of the tail twenty-four; but between the eighth and ninth from the tail one spot appears to have been lost.

Mr. Edward's description of an example found by him in February, at Banff, and of three others since found near the same spot, is thus given in the "Zoologist:"—The length nearly two inches, the greatest depth almost half an inch. Colour of the back dark glossy brown, marked along its whole length with zigzag lines of a lighter shade, one being on each side of the dorsal ridge; sides like brightest polished silver with metallic lustre; belly slate blue; tail deeply forked, greyish white, with a dark streak across near the base. On the upper lip two kidney-shaped streaks, one on each side, bluish green; similar marks but round on the lower lip, giving the mouth when closed a dark appearance. From the under side of the mouth three rows on each side of little roundish dots of beautiful light green; the first passing along the side of the head ends beneath, but on a line with a back part of the eye; the second lower down, ends a little beyond the pectoral fin; the other, one on each side, stretches along the belly, with a slight interruption at the vent, to the tail, being smaller and closer as they proceed backwards. The second dorsal fin quite visible and rounded.

There appears to be a near similarity between the fish thus described by Mr. Edward and our own; but that of Dr. Clark seems different; and the differences between them are the rather to be noticed, since, according to Dr. Gunther, the specific characters of several are not readily noticed. It is thus that a species of the Mediterranean—*M. amethystino-punctatus*—is said to be "extremely similar to our recognised species, but with the body comparatively shorter and the head longer;" a character which raises the question whether it may not be the one of which we have given the figure. There are two other species known in the same sea, of which an important character is said to be that the bright dots along the belly are each one placed on a black globular body.

THE FAMILY OF EELS.

The body is much lengthened, covered with a thick and soft skin, without the visible appearance of scales; openings of the gills small and simple. The fins without firm or bony rays; and in the British species the dorsal and anal fins are united to the tail, thus forming a single fin; no ventral fins, on which account they are termed apodal fishes. Lateral line straight when visible.

ANGUILLA.

In addition to the characters of this family given above, this genus is marked with the presence of pectoral fins, and the openings of the gills on each side close under these fins. *Anguilla*, Jonston, pl. 24, f. 7 and 8; Willoughby, p. 109, pl. G 5. *Muræna anguilla*, Linnæus; Bloch, pl. 72. *Murène anguille*, Lacepede, who appears undecided whether the Eels named by fishermen were varieties or distinct species; but Cuvier receives them as distinct, with the names *Anguilla verneaux*, *A. longbec*, *A. platbec*, and *A. pimperneaux*. *Anguilla vulgaris*, Fleming, British Animals, p. 199. *A. acutirostris*, Jenyns, Manual, p. 474; Yarrell, British Fishes, vol. ii, p. 381. *A. latirostris*, Jenyns, Manual, p. 476; Yarrell, British Fishes, vol. ii, p. 396. *A. mediorostris*, Jenyns, Manual, p. 477; Yarrell, British Fishes, vol. ii, p. 399.

It is to be remarked that Aristotle recognised two distinct species of Eels; but his authority, however great, may have been less regarded as he also taught that the propagation of the species was spontaneous, without impregnation, or a difference of sex.

Indeed while Eels were well known to the Greeks and Romans, these people had generally confused notions of their nature, as whether they were of one or several kinds, their origin and mode of increase, and even concerning their ordinary habits; so that the only thing in which they appear to have come to a conclusion was that they formed a highly-esteemed and expensive article of fashionable food. Fish of all kinds were in high favour in Greece in the days of its prosperity, so that the word *opson*, which originally comprised every sort of food except bread, at last became applied only to fish; but the Eel was among the highest of these delicacies, and Aristophanes may be referred to, to shew that a sum equal to half a crown was demanded for an Eel which had been brought from Lake Copias, in Bœotia, which country was believed to produce them of the most delicious sort. And loud, as well as frequent were the denunciations raised against the fishmongers of these times, as being extortioners who took advantage of the luxurious cravings of their customers to their own extravagant profit.

But there was at least a prominent exception to this bias in favour of these fish in an eminent people of antiquity, and the Egyptians held them even in abhorrence; for which the reason assigned by Herodotus is that in that country they were regarded as sacred to the deity of the Nile, but which Lucian appears to explain by intimating that some evil demon was embodied in the fish; and this explanation is countenanced by what is said by Anaxandrides, the Rhodian poet, to an Egyptian:—

> "You fancy in the little Eel some power
> Of demon huge and terrible;"

and it may have been for the same reason that Numa forbad its being offered on the altar of a god; while on the other hand, as I quote from Bloch, the Bœotians, whose Eels were best esteemed, were accustomed to use them as sacred offerings. Whether its being tabooed as food in the Islands of the South Sea, (and the only fish that is so,) may be due to the same idea, derived from a remote ancestry, appears uncertain.

With the ancients also the way in which the race was continued was eminently a subject of doubt or mistake; as indeed it remained to a very modern date; and several writers of some eminence have been so far in error as to have mistaken parasitic animals in Eels, and even those of other fishes, for the young of these species. Lacepede believed them to be bred within the body of the parent, although after diligent search he was not able to find them there; and Spallanzani, led by the same opinion, and to account for his own want of success in this search, explained it by saying that the parents went down to the sea to produce their young; and consequently were then beyond his reach. This remark is indeed to a large extent true, although not in the way in which he understood it; but whether there exists some difference in this respect in what are now recognised as different species, has not yet been inquired into.

As regards the difference of species among Eels, we have seen that Aristotle had no doubt, and in this he is followed by Jonston; but while naturalists of a later date were content to bury themselves in the obscurity of the ancients, fishermen were persuaded of the existence of several kinds; thus anticipating the conclusion of recent naturalists, who now describe three which have been discovered in our own country, and of which we have some supposition as regards a fourth; although in respect of the exact nature of one of them, some hesitation may still remain. Of the distinguishing habits of each of these species there is little known with certainty; for which reason it has been judged best to describe in the first place what appears to be common to all of them, and to reserve such particulars as are peculiar to each until we come to the description of the individual species.

With some reserve as regards the several sorts we have no knowledge of any fishes that are so widely distributed over the world as Eels. Mr. Lowe speaks of them as being the only native fresh-water fish of Madeira; where they abound in torrents up to the height of about five hundred feet above the sea; and Fabricius mentions them among the fishes of Greenland. They are common in every rivulet in the British Islands, and over the continent of Europe; and especially abundant in the countries bounding the north and east of the Mediterranean. We hear of them also in Japan and portions of China, with other (temperate) portions of Asia; but Philip Von Strahlenberg, in his "Travels in Siberia," informs us that they are not found in the rivers of that country. It has been commonly believed that no Eels are met with in the Danube; but the contrary is affirmed by Dr. Reisinger, in his "Ichthyology of Hungary," who says he has known them there, although not in abundance, but sometimes of the weight of twenty pounds. In Hungary they are found in large numbers in lakes and ponds.

Yet although inhabiting countries distinguished by such a variety of climate, these fish are known to be deeply sensible of changes of the season, and more especially when these changes are sudden. Severe cold is in a high degree irksome and injurious, to escape from which it is a usual resource to bury themselves in the sand or soil at the bottom of the river, or to creep into the recesses of the bank, where, in the accustomed hole, they have been careful to know there is more than one safe outlet for escape in case of danger; and here, for the sake of warmth, large numbers have been known to assemble together; as has been found the case also when buried in the mud at the bottom. In spite of this, however, Spallanzani records that in a cold winter so many Eels were killed in the marshes of Commachio near Venice, as weighed something more than six thousand six hundred pounds. But there is reason to believe that when even severe cold is gradual in its approach, it is a state of torpidity, and not death, that is produced. In the "Annual Register" for 1778, p. 99, Dr. King is quoted as saying, on the authority of the Russian Consul, that in Russia Eels are designedly exposed to the frost in order that they may be carried safely to a distance. They are then packed in straw, and after four days, when thrown into cold water, they become perfectly recovered. Other examples of similar facts might be produced; and it seems probable that in the sea they find a higher amount of protection and comfort than anywhere in fresh water; and in the milder climate of Cornwall, when the ebbing tide had left a sheet of ice on the shore, large Eels, which had been taken from holes in a pier left almost dry, were found still in possession of their usual activity; but the philosophical experiments of John Hunter have placed their history in this respect in an intelligible and satisfactory light. With a thermometer formed for the purpose he found the heat of the stomach in an Eel to be 37°; and then, having placed the fish in a cold mixture, which at first he ascertained to be at 10°, but which afterwards was reduced to a still colder temperature, the heat of the stomach was brought down to 31°, and the creature appeared to be dead; and yet on the following day it had become restored to life and activity.

This illustrious physiologist remarks further, that the presence of life allowed the vital heat to be lowered to two or three degrees below the freezing point; but after this it resisted all further decrease; and when the powers of life had become expended by the exertion of thus resisting decrease, the creature became frozen like any other dead matter.

An Eel in a weak condition was found to have the heat of its stomach at 44°, which was at the same time the temperature of the air. It was then put into water heated to 65°, and kept there for fifteen minutes; in which time the fish had acquired the same heat as the water; and it was noticed that a living and a dead Eel received an equal amount of heat and cold in an equal length of time; and he appears to think that if the whole body of a fish should become really frozen, it would have become past recovery by thawing. As a frog was found to be able to digest its food when the heat was at 60°, but to have lost that power when it was below 40°, the same appeared to be the case with the Eel; which circumstance will explain what has been observed of this fish in captivity; and in a short series of observations on the upward migration of young Eels, we have noticed that they do not shew themselves while the temperature of the stream is below the annual medium temperature of the air.

There is no need that our attention should be engaged in giving an account of the surmises which were hazarded on the subject of the productive organs of these fish, the error of which was caused by the expectation of finding in their bodies a close resemblance of the milt and roe of most other fishes, to which, however, their organs of propagation bear in some particulars but a distant likeness. But their situation in the body is the same, and both the milt and roe lie along the course of the back in a double, thin, and convoluted stripe, which bears the appearance of fat rather than an organ embedding grains of seed, which are in reality enveloped in an oily substance, the use of which appears to be to afford protection against changes of temperature that might be hurtful to the spawn before it is shed. That the small grains embedded within this soft and greasy covering are truly the spawn of the fish is proved by the examination I have been able to make, as also by the inquiries of other observers. Thus a portion of this roe was placed in a microscope, when there were distinguished a large number of globular grains, some of which, according to the notes then made, "were a hundred times larger than others; from whence the conclusion is that some are approaching to maturity, and that their exclusion is in succession;" a fact rendered certain by repeated observation. It is added:—"It is impossible to imagine that all these could ever have been hatched within the body, and still less without the circumstance having been long since ascertained. The small size of the orifice of egress is also a proof of the same thing."

When this roe was burned in the flame of a candle it gave out a strong and peculiar smell, which resembled that of the roe of a Ling or other fish when roasted, in proof of which it was submitted to the judgment of one who was well acquainted with such a smell, but who was not aware of the object of inquiry; and the opinion of its nature was decisive. The examination of this subject extended over several years from 1828, but the subject was further traced by my late son, Richard Quiller Couch, while residing at Penzance, the particulars of which were communicated to the "Zoologist," 1847, p. 1830. "Last summer," he observes, "I took a quantity of mud from a spot much frequented by Eels, and carefully examined it to see if there were any (ova) in it; and, after testing several specimens without success, I was at last gratified by observing the Eels, small and transparent, lying on the surface almost motionless. They rapidly grew, and in ten days acquired strength and size to swim about."

It seems certain that when there is no hindrance these fish will choose the sea, in harbours chiefly, in which to shed their spawn, where it is scattered loosely in the sand or soil, and from whence it may be dislodged and washed into deeper water without injury; but there is proof also that it is sometimes deposited at the bottom of a stream of fresh water; and at a meeting of the British Association for Science a gentleman mentioned as within his own knowledge, that on the last day of August a considerable number of young Eels were seen to rise up through a small opening in the sand at the bottom of a small stream—the Ravensbourne; which fact was further confirmed by the observation of another gentleman of high scientific acquirements. As evidence to the same purpose we quote some remarks from a paper in the "Quarterly Review", written, I may be permitted to observe, by the Rev. William Houghton, F.L.S., of Preston Rectory, near Wellington, Shropshire; in which he refers to Mr. Young, who, by digging in the month of October in the gravel banks of the River Shin, found the place, as he says, "alive with young Eels, some of them scarcely hatched, at the depth of from five to fifteen inches."

At the place where a river passes into the sea, the salt water, from its greater specific gravity, flows beneath the fresh, and there the young Eels are seen to mount from below into the latter, although perhaps the downward current may offer a more considerable obstruction to their progress. This passage upward is performed by day, and it is said to be suspended after night; but these little active creatures, all of which are of one size, and not larger in the body than a darning-needle, are persevering in their exertions, and, as far as I have observed, go on in a loose arrangement near the bank; but in the larger and deeper rivers they are described as forming a closely-compacted company, in a rather narrow but long extended column, where they are ready to seize the advantage of every eddy or slack water in order to ease the labour of their efforts. A formidable obstruction causes them to sink to the bottom, and perhaps to hide themselves, but the exertion is again renewed, and never without ultimate success.

They are known to climb up over high and steep ascents, even to the extent of twenty feet above the water, when these stand in their way; and this they do not only with perseverance, but with no small amount of skill; of which we possess some remarkable evidence from observation. This passing upward is indeed in some degree regulated by the state of the season, as being mild or cold; for while very young Eels have been obtained at the ebb of the tide so early as the 2nd. of January, after watching a river with care they have not been observed passing up the stream until the middle of March, and rarely even then. The more usual season begins with April, but may not be until May, after which they do not cease through the day, except under particular circumstances, presently to be mentioned, until the autumnal equinox; beyond which no more have been discovered. The hindrances here referred to are the accident of a muddy condition of the water, which is distasteful to the old Eels as well as to the young, so that the former will quit a river or pool to avoid it; and also a very low state of the stream, when they do not avoid it or lie still from the merely deficient quantity of water, for a dribbling of what is pure will lead them onward, but from its polluted condition, of which these fish are quickly sensible. When thus situated in consequence of the dryness of the season, no Eels have been seen to pass for five or six weeks; while afterwards an abundant fall of rain has been soon followed by an upward migration; which at this early stage of their existence appears to be essential to their well-being.

But although delayed by a muddled or nauseous condition of the water, Eels are not to be hindered by mechanical difficulties; and it is amusing to trace the means to which they have recourse in passing over barriers that might seem inaccessible to their efforts. It was at a time when a moderate but rapid stream had from dry weather become a small cascade, that the only way of ascent was up the declivity of a perpendicular rock, from which on one side hung some moss and herbage into the water below. When these Eels in succession came to this place they moved about rapidly near where the stream fell down from above, and presently disappeared; when looking more closely it was seen that on one side of the projecting rock they had crept among the fibres of the moss that hung downward, and were moving upwards with wriggling motion, like worms; but resting at times and taking care to keep at a safe distance from the falling current. At last they reached the top and settled into rest, with the head a little stretched out into the river; but after a time, seizing a favourable moment of recovered energy, they put out their renewed strength and moved upward in the stream. Those of them, however, which had taken the other side of the rock were differently situated, and their task was to thrust themselves over a sloping surface by dint of their unaided exertions; in accomplishing which some quitted the water altogether; but they still kept on a moist portion of the ascent, up which by a slow and laboriously serpentine action they contrived to urge their way to reach at last some moss, the support of which they hastily made use of to secure success. It was amusing to observe that it would sometimes happen that a head would be thrust out into the current, where observation shewed that it ran by too strong to be encountered, and then it was withdrawn to seek a more favourable spot; while others venturing thus too far were washed down the current, and had the labour to go over again. On one occasion while watching this continued succession of Eels, a Flounder made two attempts to stem this downward current, but these efforts were without success.

Similar to the extended notice of this migration that we have given is one by Mr. Arderon, in the Transactions of the Royal Society, vol. xliv, who saw them as they passed up the flood-gates of the water-works at Norwich, of the height of six feet, in order to reach the water above; and we close our account of this interesting subject of the influence of instinct with an extract bearing on the same, from Jesse's second series of "Gleanings in Natural History," where, referring to the Thames, he says, "At the locks at Teddington and Hampton the young Eels have been seen to ascend the large posts of the flood-gates, in order to make their way when the gates have been shut longer than usual. Those which die stick to the posts; others, which get a little higher, meet with the same fate, until at last a sufficient layer of them is formed to enable the rest to overcome the difficulty of the passage. A curious instance of the means which young Eels will have recourse to in order to accomplish their migrations, is annually proved in the neighbourhood of Bristol. Near that city there is a large pond, immediately adjoining which is a stream. On the bank between these two waters a large tree grows, the branches of which hang into the pond. By means of these branches the young Eels climb up into the tree, and from thence let themselves drop into the stream below, thus migrating to far-distant waters, where they increase in size, and become useful and beneficial to man. A friend of mine, who was a casual witness of this circumstance, informed me that the tree appeared to be quite alive with those little animals. The rapid and unsteady motion of the boughs did not appear to impede their progress."

Mr. Thompson informs us, from Mr. Patterson's work on Zoology for schools, that in Ireland fishermen have had the wisdom to provide haybands, which are hung over the rocky parts of rivers to help the Eels in overcoming the obstructions which lie in their way; and Mr. Daniel, in his Supplement to Rural Sports, further says that in the same country a kind of fishery is employed by means of ropes of straw laid across the stream, into which these Eels entangle themselves, and thus are drawn on shore. Within my own observation, when these young Eels have quitted the water, and are come to a dry spot, they have always turned away in search of moisture, which they follow; and so when a season is dripping with wet, they sometimes wander into extraordinary situations. Thus, when a leaden pipe which conveyed water from the roof of a house to a cistern, that was fifteen feet above the ground, had become obstructed, and in consequence a portion of it was cut off, the pressure of the water in the upper part was seen to thrust out, head foremost, three Eels, each twenty-two inches in length, and no two of which were able to pass each other in the tube. Instances of a similar kind are mentioned by Mr. Thompson, in his 'Natural History of Ireland.' The fate of these young Eels for the most part appears uncertain; but the numbers which again pass downward are seen to be considerably less than can be accounted for without supposing that they meet with many devourers; among which man may be the least formidable, although in some places these little fish are sought after, and are formed into cakes to be fried as food. On one occasion there were for sale in the market at Exeter two cartloads of them, so small as not to exceed the size of a stocking-needle, and each load weighing four hundredweight. These were already prepared for the table, and were dispensed to customers at fourpence the pound.

Among these early migrating young Eels there are occasionally found examples which are distinguished by remarkable transparency, so that the internal organs, with the action of the heart and blood-vessels, can be easily traced. These are popularly termed Elvers, although this name is sometimes applied indiscriminately to all young Eels, but I have not been able to decide that this transparency is a character of any one of the species of this family as distinguished from the others I have not known them to form one of the company of migrating young black ones high in the fresh water, except in the Fowey river, where they kept together; but they have been met with as well in January as in June; and after a confinement of a few weeks in a tank there has not been an approach to a change in the appearance. In one instance a sketch shewed the snout remarkably protruded and sharp, and in another decidedly blunt.

But in addition to this early and regular tendency to migration, these fish are also occasionally disposed to a casual wandering; which is sometimes caused by the wish to escape from the confined limits of a pool, to which a vagrant propensity has carried them, or in which they have been placed; and where the water has become muddled or is nauseous. Thus an Eel of considerable size was placed in a muddy pool in a dry season; and soon afterwards, having examined the border in all directions, it left the water and passed over the dry ground to a neighbouring river. When also, in the course of examination into the structure and habits of these fish, examples were placed in vessels of pure water, which was kept a few inches below the brim, it was observed in every case that they soon made their escape, which was always effected in the night. In some instances these runaways were discovered in the street, as they were on their way to the river, and brought back; but they remained no longer than until the return of darkness; and these escapes were through passages not easily perceived, or to be guarded.

The manner in which these fish manage to pass over the edge of the vessel in which they have been confined, is not less characteristic than is the structure and facility of action of the organ by which it is accomplished, in which respect, as we shall see, they much resemble the Conger. Of the larger number of vertebræ with which they are furnished, amounting, according to Lacepede, to a hundred and sixteen, those nearest the tail are so formed as to allow of great flexibility; by which, as may be familiarly noticed, these little creatures, when meddled with, are in the habit of tying this extremity into a knot; but the sensibility of the part in feeling, and that of a peculiar kind, is also great; and it is supported by a special organization of which by and by there will be given a more particular description. It is by this combination of structure that these fish are able, first, to ascertain the nature of the boundaries within which they are confined, and then to apply their handlike tail so as to grasp the edge, and by a convoluted contraction or retraction of the muscles to lift the body over.

There are times also when this wandering propensity of the Eel appears to be brought into action by a craving for some unusual kind of food, or it may be, even for the mere love of adventure. An Eel has been taken on the land by means of a hook baited with a worm, and set to catch a bird. It is said to have been known to devour newly-sown peas in a garden; and I have been credibly assured that one was found in a field of turnips at the distance of a quarter of a mile from a river; all which circumstances, with other direct proofs, afford evidence that these fish are able to live for a long time out of the water; which circumstance is indeed explained by the fact that their gills are closely shut up from the drying influence of air, and that from being smeared over with glutinous moisture, the skin is always preserved from becoming dry, which process of drying is the cause of death in many species of marine animals.

It has been disputed whether the growth of Eels is speedy or exceedingly slow; and Lacepede had formed the opinion of its being so greatly delayed, that many years must pass before they can reach the size in which they are usually found; but to compensate for this, he supposed their natural length of life to be lengthened to almost a hundred years. And in support of these suppositions he adduces the authority of a friend who placed in a tank sixty of these fish of very small size; where after nine years they had only increased from the length of nineteen centimetres to twenty-six; but this writer takes no note of the food supplied, nor does he appear to be aware of the effect of limited confinement on the growth of fishes; and his conclusion is disproved by an experiment of his countryman M. Coste, who placed young Eels in a reservoir, with a sufficient supply of food, and in four or five years they had attained the weight of from four to six pounds.

Mr. Daniel produces an authentic instance of an Eel which lived in a well for at least upwards of thirty-one years; but we cannot venture to admit his supposition that in Lough Neagh they have grown in four months from the size of small pack-thread to that of a man's wrist or leg; and our observation leads us to think that the very young ones of about three inches in length, which have gone upward in the spring, at their return in the autumn are larger than a swan-quill, or in some cases even of the size of the little finger of a child. Whether any remain in fresh water through the winter, in cases where a passage downward could be accomplished without difficulty, appears uncertain; but it seems certain that the larger number reverse the course which they took in the earlier months of the year; and in doing this the season also is altogether reversed. Instead of the day the darkest night is chosen; and moonlight or even a bright light effectually delays the movement; while a sky that is overcast and a murky air afford strong enticement to action. It is on these occasions that large numbers are caught in baskets of wicker-work, which are placed across the streams they frequent, with an open mouth presented across the current.

But restless and wandering as is the Eel, there are times and situations in which it indulges in a state of rest or apathy, which may be even a condition of profound sleep; and from which it may not be easily roused. In the second volume of the "Zoologist," the Rev. J. C. Atkinson observes, "In the broad fleets on the marshes during hot weather in summer, they seem to bask near the surface of the water, resting meanwhile on the support of the weeds; and on being disturbed by a boat, or, if lying near the side, by a passer-by, they quickly descend, making a kind of disturbance in the water, which exactly resembles that caused by the emergence and instantaneous re-immersion of the dabchick. Sometimes on these occasions the Eel in its attempt to descend, throws itself completely out of the water. On a calm summer's evening I have seen them in some waters throwing themselves out much after the manner of the Porpoise when leaping; performing, that is, a kind of summersault. I have witnessed this but rarely, and never in streams."

We have observed that these fish are at all times highly sensitive to cold; and when it is severe, its earliest effect is to deaden their appetite for food; at which time they seek shelter in some retreat, where they can hide themselves in a bed of mud; or creep into a hole in the bank of the stream;

where they have been discovered huddled together in large numbers, apparently for the purpose of mutual warmth. In spite of this, however, when the cold has become intense, it has had an influence more or less fatal according to the suddenness or otherwise of its approach. If the chill be sudden, we have already said that the effect is a condition of torpidity, from which restoration is possible; but if the attack be more gradual, or with casual intermissions the result is mortal; and very large numbers have then been discovered frozen to death: an instance of which in enormous quantities as occurring in the marshes of Commachio, in the neighbourhood of Venice, where they are the objects of a large trade, is mentioned by Spallanzani, and reported by Lacepede. Yet it is remarked that they survive the cold winters of Greenland with impunity; for perhaps the ice itself may prove a protection in their better shelter, by its non-conducting power and little liability to variation.

Eels have been seen to devour the leaves of cress as they float in the water; but their ordinary food is animal, of which, however various, it is essential that it shall be fresh, and it is more acceptable if alive; for their senses of smell and taste are quick to reject what is even slightly tainted. But when pressed with hunger they become voracious, and instances are reported where they have laid hold of living animals of no small size and formidable nature. The waterhen, and in several instances a rat, have been found in the stomach of an Eel; and on examining one that was found floating on the River Tamar, a snake only a little less than the Eel itself was found in its stomach.

But on the other hand they are liable to the depredations of several enemies; of which when of large growth the otter is perhaps the most formidable; and the heron also destroys many, although not always without danger to itself. More than one instance has been known in which, while its powerful bill has pierced the body of its prey, the agony of the fish has caused it to twine itself round the neck of its foe and hinder its flight, or cause its death. A contest between a cormorant and Eel for victory and life is not a little interesting; and the more so as an active Eel is not easily persuaded to pass into or remain in the capacious stomach of its foe. A cormorant was seen with its throat and neck much distended; but observing that itself was closely watched, it endeavoured to get to a distance, in doing which its efforts to retain or swallow its prize appeared to have become relaxed, which an Eel seized the advantage of and escaped from its jaws with great activity. The bird immediately dived after it, and again brought the captive to the surface; but experience had taught the lesson that something further was needed before another attempt should be made to gulp down the prey. Violent and repeated pecks were made with the powerful bill along the length of the fish; and then, supposing it to be sufficiently disabled, it was taken up and held across the mouth as if to be swallowed. So much liveliness remained, however, to shew that the fish was not yet rendered sufficiently limp and helpless, and it was again treated in the same way as before, with repeated pecks, until it was reduced to a condition to prevent all further fear of any effort to escape.

As food among ourselves Eels have been valued differently in different districts; for while in the west of England they are little esteemed, and in Scotland are altogether rejected, in London the sale is said to be at the value of £20,000 yearly, and the numbers sold in Billingsgate in the same time are little short of ten millions. Turner remarks in his "History of the Anglo-Saxons," that in the fifth century, and we may add, probably long before, when the agriculture of Britain was the best that was known among civilized nations, a portion of it consisted in appropriating the marshy grounds to the breeding of Eels; and this practise continued at least through the middle ages, having probably been learnt from the Romans while settled in our island; for we have reason to believe that these people were accustomed to procure these favourite delicacies from their own marshes, and we do not find them mentioned by Columella as being kept in their magnificent fishponds.

Venerable Bede, who lived in the north of England, in his "History of the Anglo-Saxon Church," mentions only two sorts of fisheries for which Britain was famous, which were for Salmon and Eels; and the value set on these last-named fish at luxurious and noble tables may in some measure be judged from an incident related of the magnificence of the famous Archbishop Thomas a' Becket, who, when he travelled in France, expended the large sum of a hundred shillings in a dish of Eels. Nor was this altogether a solitary instance, and as a further example of the interest felt in these delicacies, it appears by a charter granted by King Ethelred, in the year 998, or rather by Bishop Wilson's grant, that the monks of Salisbury were entitled to the tithes of Eels taken from the fishponds, together with the right of taking fish with a net in the vivaria or stews, for one day in the year. Also when Terracina, a sea-port of Italy, was besieged by the Turks, the inhabitants made a vow that they would give twenty thousand Eels to Saint Benedict yearly, if by his intercession they should be delivered from the danger to which they were exposed. A few days afterwards the Turks raised the siege; and in gratitude the Eels were carried every year to the Benedictine Monks until modern times.—(Misson's Travels.)

In the poem "Breton's Ourania" we read—

"The Silver Eel,
Which millers taken in their ozier weele,
Dwell in the rivers as principall fish,
And given to Pan to garnish thy dish."

At a later date also Tusser recommends,—

"Put Eels in stew
To leave till Lent,
And then to be spent."

But they were not thought altogether favourable to health; and in an ancient book of repute on the practise of physic, "Regimen Sanitatis Salerniæ," it is said:—

"Who knows not physic should be nice and choice
In eating Eels, because they hurt the voice:
Both Eels and cheese, without good store of wine
Well drunk with them, offend at any time."

It may be supposed that the different kinds of Eels are caught indiscriminately, and we shall by and by take occasion to mention the difference of proportion which thus they may be supposed to bear to each other; but taken together it is estimated that little short of ten millions of these fish are brought yearly to Billingsgate, chiefly from Holland; so that when a tax was paid on the importation of them, it amounted in one year to almost a thousand pounds.

We may observe, as bearing on the anatomical characters common to each species of Eel, that, as in the development of embryo fishes the ventral fins are the last to make their appearance, their being altogether wanting in this genus has been thought to imply that the race is of an inferior kind in the scale of nature, as compared with several others; and something similar might be judged from the deficient development of the scales, the absence of which has been supposed in these fish. Their skin is known to be thick and tough, so that when stripped from the body, as is cruelly done when the fish is prepared for cooking, in some countries it is in common use as a bag or purse—a fact referred to by Shakespeare; and we are informed that in ancient times it was employed as a whip to enforce discipline in schools. On the fish its thickness and slimy texture are of service in preventing the escape of the moisture within the body which is of importance to the life of the animal when exposed to the air; but the scales which are embedded in it are not easily discerned, and therefore have been supposed to be altogether deficient, thus offering a striking contrast to fishes which on that account have been supposed more perfectly organized. Thus, taking as an example the family of Herrings, the scales in them are so far protruded that only a small portion of each remains attached to the skin, and that portion is a film of the slightest texture. In other fishes, as the Sole, it is only a small portion of the scale that is protruded, while in Eels all the scale is kept within the skin, where it lies embedded beneath the outer layer, or scarf-skin, with the edge of each not overlapping the next, but lying side by side. In the Conger the skin is altogether deficient of scales, but to obviate the conclusion that these apparent deficiencies of development are marks of a low condition of these creatures in the scale of nature, the far more important organizations of the brain and nervous system, and even of the muscles, are displayed in a higher degree than in a large proportion of other fishes; and in consequence the faculties of intelligence are in a corresponding condition of perfection. Thus the brain is of considerable length with its lobes well marked; and the nerves of special sense, which are those of the ear, taste, and smell, are large and highly sensitive; so that few fishes are better qualified to discern external objects, or to employ their faculties in their own pursuits; and several instances have been mentioned of the consciousness they have shewn of kind treatment, so as to have become familiar with those who offered them food. Aristotle has noticed that they were attracted with agreeable scents, and Ellis says of some in the South Sea Islands that they came to be fed at the sound of a sharp whistle.

The remarkable sensibility of touch in the tail of this family of fishes has been already noticed, but we owe to Dr. Marshall Hall the knowledge of a particular organization of the blood-vessels of this part, which beyond doubt is closely connected with the uses to which this organ is sometimes applied. This eminent inquirer remarks, "It has been supposed that the pulmonic heart alone, with the aid of some subsidiary powers of the circulation, propelled the blood. I have discovered in one species of fish that which will lead us to view this opinion with distrust, and which will point out to us the fact of an unsuspected addition to the power and action of the heart in some species of animals. This structure is seen, even with the naked eye, in the tail of the Eel. Its form, action, and connexions are, from the degree of transparency of the part, still better traced by the assistance of the microscope. Placed under this instrument, a particular spot near the extremity of the tail of the Eel, easily discovered, has the appearance represented" in "the drawing of the ventricle of this caudal heart. The different vessels unite and form a connexion with this ventricle near its highest point."

The course pursued by the blood in these vessels "uniformly tends towards the highest point of the ventricle; from this point it seems to be slowly propelled or drawn into the ventricle; by a sudden contraction of this it is gathered into a drop, and propelled with great velocity, and at first with the peculiar appearance of successive drops, along a vessel which ascends along the inferior spinal canal, and which must, although it pursues a direction towards the heart, be considered an artery." "The action of this caudal heart is entirely independent of the pulmonic heart; while the latter beats sixty, the former beats one hundred and sixty times in a minute. It continues for a very long time after the influence of the pulmonic heart is entirely removed. The vessels which issue from the caudal heart appear to have a particular distribution to the spinal marrow;" but it is evident from the figure that the current of blood is directed to, and not from the orifice or outlet forward from the caudal heart; so that these smaller vessels collect the blood into this organ, and do not distribute it.

Another remarkable organization in this genus, or at least in the Eel and Conger, but of which the use is as yet unknown, is described by the Rev. W. Houghton, F.L.S., in the "Journal of Microscopical Science," with a plate, vol. iv, N.S., but which requires further investigation. He remarks that having been occupied at intervals in dissecting a number of Eels and a couple of Congers, he observed the invariable presence of two subtriangular openings in the fleshy portion of the head, just at its juncture with the spinal column. His first impression in regard to the use of these orifices was that they were connected with the auditory organs; but, he adds, although Mr. Cholmondeley Pennell, in his work, "The Angler Naturalist," asserts the presence of an ear or auditory aperture amongst the mucous pores about the head, from the most minute examination of a large number of the heads of Eels, he confidently affirms that no such auditory aperture exists. Upon inserting a bristle in each of the orifices above referred to, and clearing away the flesh, each bristle was found to have traversed a closed-in tube in the skull, and to have come out just above the bone of the orbit; but on close observation they were found to have no connection with the organ of hearing. These tubes are very slender, and each one of them terminates in a membranous fold in the tissue just beneath the skin, above the eye; which fold contains a thin fluid, that does not bear any resemblance to mucus. It may have some connection with the habits or faculties of these fish, that the whole of the optic nerve does not proceed to be joined to the optic lobe of the brain; but that portion of it which passes to another part of the brain must be connected with some other function besides that of discerning outward objects.

It is a character of this family to have also an air-bladder of considerable size; at the middle of which is what may be denominated a gland, with conspicuous blood-vessels; by the action of which the air is secreted into the bag.

It may be deserving of notice, further, that while the common name of the Eel is of Anglo-Saxon origin, the word Fausen was anciently used for it, as it was also by Chapman in his translation of Homer. Junius also, in his "Dictionary Nomenclator Octolinguis," 1619, says, "Fausen, prægrandis fausen, Eels;" which appears to confine the word to the larger examples; "Minime, Grigs, media Scaffling dicitor." Skinner also and others thus explain the word, and Hilpert says "Fausen—der meeraal"—the Sea-Eel or Conger.—"Notes and Queries."

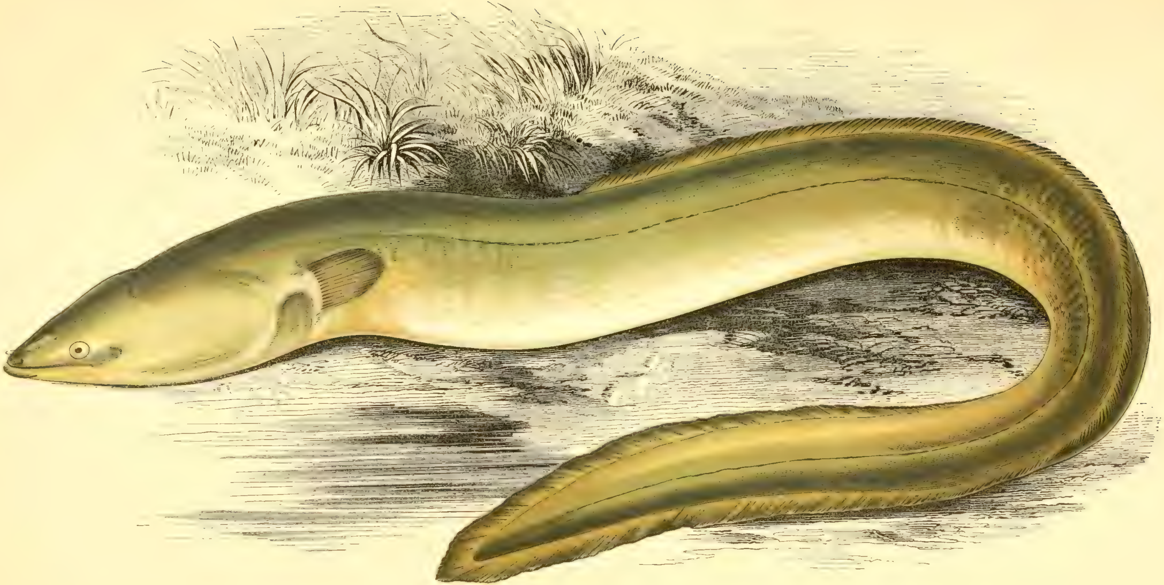
SHARP-NOSED EEL.

Anguilla acutirostris.

This is the most abundant and most valued of the British species of Eels; and in Ireland we observe that in letting to rent the right of taking fish in rivers, (in Ulster,) that of fishing for Eels is to be undertaken separately from the fishery for Salmon. As the best known of this family, therefore, it is in a special manner the subject of the observations that have been made on the habits and history of the race; with the reserve of such distinctions only as will be given in our notice of the kindred kinds.

Mr. Thompson has given an account of the large numbers of these fish which have been caught in his native Ireland; but there appears to exist along the northern shores of the Mediterranean, so far east as Greece, a more regular fishery for Eels than with us; and it is there carried on from Michaelmas to the "Feast of the Kings," chiefly by means of wicker baskets sunk in the sea. When caught the fish are killed by being buried in salt; and then they are salted in bulk in three divisions according to their size; the first being such as weigh from a pound and a half to seven pounds, and the third from two ounces to half a pound. With us the smaller Eels are sometimes potted or maranaded; but we have reason to know that Congers of small size are thus not unfrequently made to pass for Eels. An amusing account of the cookery and sale of Eels at Naples may be seen in Dr. Badham's work, entitled "Fish Tattle."

According to their usual growth, an example that weighs half a dozen pounds is considered large; but there are instances on record which have greatly exceeded this. A fisherman brought the information of one, which was the largest he had



[illegible]

[illegible]

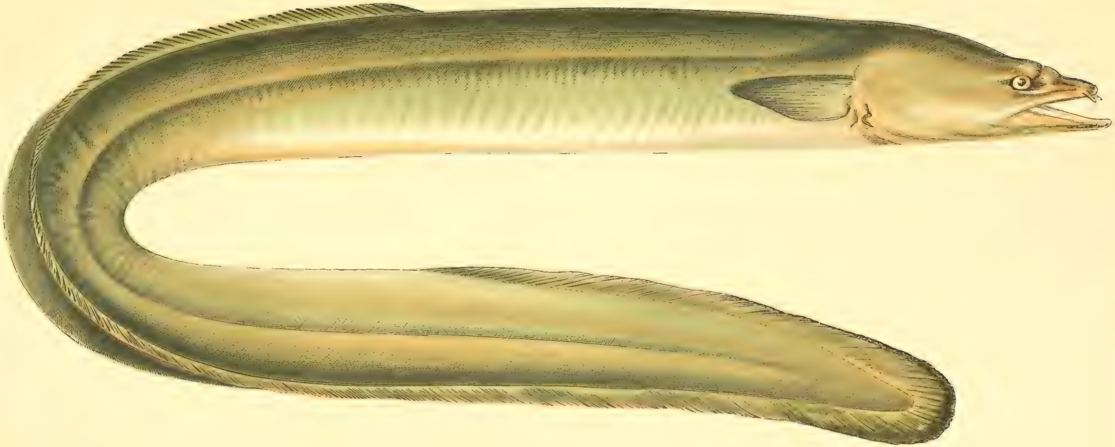
ever seen, and weighed ten pounds. One which was caught in Hackney River, is noticed to have been of the weight of twenty-seven pounds, and there is a notice of an example taken in the Medway, not far from Rochester, which weighed thirty-four pounds, and measured six feet in length, with a girth of twenty-five inches; but even this is exceeded by an instance mentioned by Mr. Daniel, of one taken in Kent, which weighed forty pounds, and in length measured five feet nine inches, but, strangely, its girth is said to be (only) eighteen inches. I possess a printed note of one that weighed sixty-two pounds; but I must confess that I regard this as apocryphal. The general proportions of this fish are lengthened, flexible, at first round, compressed backwards from the vent. The head rounded over the top, from a meeting of the muscles of the face, tapering forward to the snout, which is moderately slender, and at its point are two sharp perforated barbs; another obscure pair of nostrils; under jaw protruding beyond the upper; lips fleshy; small teeth in both jaws; cheeks full; eyes small, opposite the corner of the mouth. Orifice of the gills small, with a soft border, the opening in front of and a little below the root of the pectoral fin. Lateral line straight; the surface of the skin soft and slimy, so as to render it difficult, even to a proverb, to hold the living fish in the grasp. In an example twenty-five inches and a quarter in length, the distance from the point of the upper jaw to the origin of the pectoral fin was three inches, and to the first rays of the dorsal fin eight inches; to the vent eleven inches; from which point begins the anal fin; the colour of different degrees of intensity of dark brown or green, the belly yellowish or white; the cheeks lighter; eye pink, red, or yellow; pectoral fin dark blue; other fins generally the colour of the body.

DUBLIN EEL.

Anguilla Hibernica, NOBIS.

We have already noticed the likeness which the different species of Eels bear to each other, and the influence this has had in preventing those which are truly distinct from being at all times clearly separated from others. And to this another hindrance will be found in that proneness to variation in appearance which arises from variety of situation in regard to water and soil; to which we add, that even a close description of any one of the species is not always sufficient to enable an observer to decide concerning it, unless he has also brought it into comparison with others that are nearly allied. It is from these considerations that we feel some hesitation in coming to the decision that the Eel we are going to describe is a distinct kind from others which are regarded as natives of the British Islands; but on the other hand, after a near comparison with our other species, as well in reference to its general aspects, as also in regard to a difference in several particulars of form and proportions, the opinion that as a species it is distinct greatly preponderates; and we add also, that it appears closely to answer to the kind which Cuvier has designated with the name of *A. longbec.*

The example described, and from which our figure was drawn, was procured from the River Liffey through the kindness of R. Palmer Williams, Esq., and it will rest with the naturalists of that city, whose activity in the cause of science has already produced rich fruit, to decide further on the subject, as also to ascertain what peculiarity there may be noticed in its habits. Mr. Thompson says that he had observed an Eel from Strangford, which he supposed to be different from the recognised species of British Eels, but in



DUBLIN EEL

CCXXXV

which the snout was shorter than that which he takes for the *A. acutirostris;* which circumstance has produced in me the supposition that the former is the kind which British naturalists have known by the name of Sharp-nosed Eel, and that the Sharp-nosed Eel of this gentleman is in truth the species we designate the Dublin Eel.

The length of the specimen was two feet four inches; the body stout and round, broad over the back; head wide, rather flat, sloping forward to the projecting snout, which is narrow, slightly rounded above; gape moderate; under jaw longest, wide, but thin; the nasal tendrils wider asunder than in a Conger of the same size, and more slender, longer than in the Sharp-nosed Eel. Eye rather small, in a cavity, and before it a prominence just below the nostril. Cheeks full. Length of the body from snout to vent eleven inches and three fourths, from snout to the opening of the gills two inches and five eighths; length of the pectoral fin an inch and one fourth, more extended than in the sharp-nosed species, and not so round. Teeth in both jaws thickly set, a bed of them of considerable breadth in front of the lower jaw and in front of the palate; tongue free. Lateral line high at first, sloping to the middle at about half the length. Dorsal fin thick at the root, wide where it joins the anal to form the tail, and each of these fins posteriorly wider than the body. Colour brownish green, whitish below; the tail dark at the border.

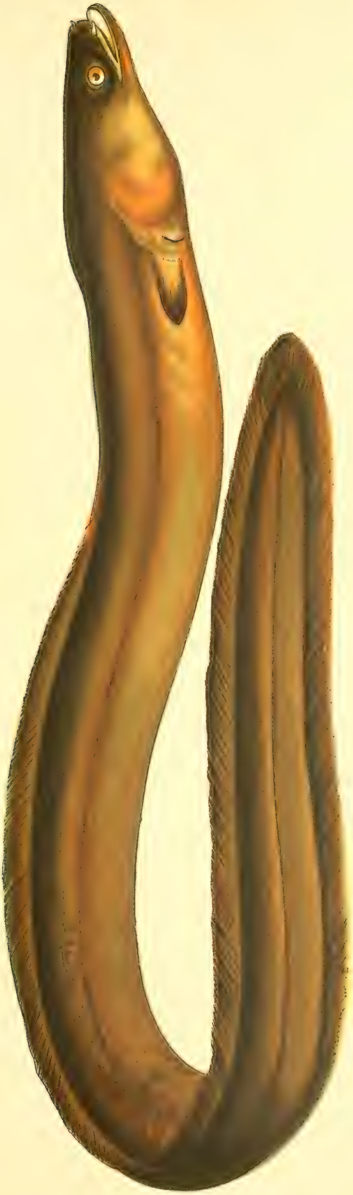
BROAD-NOSED EEL.

Anguilla Latirostris.

It seems probable that this species is as widely distributed as either of the others known among us; but it does not appear to be anywhere in large numbers. It has also been doubted whether its habits of migration, especially when young, are the same as those of the Sharp-nosed species; and yet when examining those little Elvers, or transparent young ones which have been found near the low-water mark, an example which resembled the Broad-nosed Eel has been seen, as well as that which has been distinguished with a long and pointed snout.

It has been noticed that those who trade in Eels have long been aware of a difference between the several kinds; and this Broad-nosed sort is quickly marked out by them as of inferior quality for the table. When at liberty also these kinds usually keep separate from each other, although sometimes they are found mingled together in the same net.

The present species is decidedly voracious in its appetite, and it is described as being more accustomed than the others to seize and feed on living fishes; but in general their habits in this respect are much the same. And as regards its description this kind will be best known by comparing it with the others; and especially with that which stands first in our enumeration; its most obvious difference being the broader and more blunt or rounded form of the head toward the snout; which difference was formerly believed to mark the distinction of sexes. Pennant also notices that the skin is thicker than the first-named; the gape somewhat larger; as are also the eyes, which are situated further back. The colour is an uncertain mark of difference in these fishes; but there is an appearance in this of a greater disposition to dusky or brown.

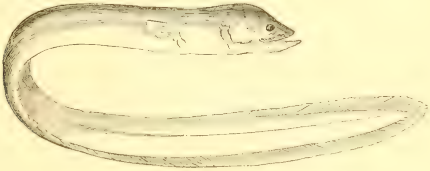


SNIG EEL.

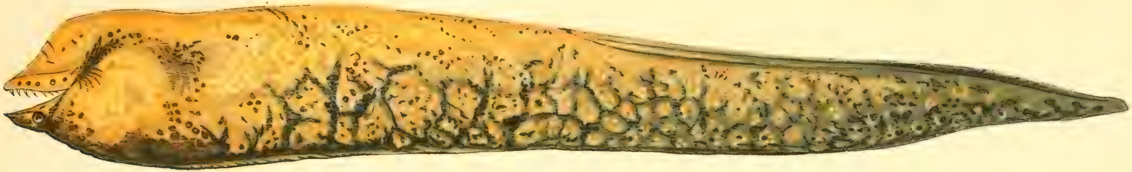
Anguilla mediorostris, Yarrell; Br. Fishes, vol. ii, p. 401.

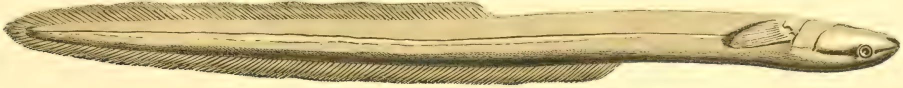
It seems generally allowed that there are not known any certain external characters by which the Eel thus designated by Mr. Yarrell may be definitely distinguished from others; it therefore becomes a question how far the difference between them in the processes of the vertebræ, and their entire absence in this species on the first five of these bones from the head, can be relied on as furnishing a sure and constant mark of its distinction from the others. I have seen Mr. Yarrell's specimens when in that gentleman's possession, and it is believed that they are now in the collection of the British Museum; but some hesitation on the subject still remains, since there does not exist any external mark by which this kind is to be readily recognised. We therefore content ourselves with observing that this so-called Snig Eel is supposed to be generally of smaller size than the others; and that more particularly where in the other Eels the first vertebræ from the head are strongly armed with elevated and diverging processes, to the latter of which the ribs are attached, in the Snig there are none, but that the vertebræ are almost entirely smooth. A question arises whether this may be the fish which Mr. Jago, at the end of Ray's "Synopsis Piscium," has termed a Free Eel, *(Anguilla libera;)* and of which he says, "A Congro differt sapore jucundiore, et ossiculorum defectu, quibus Congri abundant;" this supposed absence of ribs has not otherwise been noticed.

But while leaving these matters for further inquiry, we venture to bring forward the claim of another supposed species, which



has been called by the name of Grigg, and which Mr. Yarrell conjectured to be the *Anguille platbec* of Cuvier. I have never seen it but of small size; but the form of its head, as being more elevated behind, and short and sloping forward, is so different from the others, and the body generally more compressed, that I feel much disposed to consider it distinct. But of its history I know nothing further than that it has been obtained from the border of the tide when much ebbed. The arrangement of mucous glands in front of the eye in this last supposed species is different from that of other Eels.





FIERASFER.

This genus is separated by Cuvier from that of *Ophidium*, with which it had been mingled with the character of having the dorsal and anal fins united to form the tail, as in the Eels; the body lengthened and the vent far behind, as in these fish, but with the distinction from the genera *Anguilla* and *Muræna*, in having the openings of the gills widely cleft. It is also without barbs above or below the jaws. Apodal fishes.

OPHIDIUM EEL.

BEARDLESS OPHIDIUM.

Beardless Ophidium,	Willoughby; p. 113, Table G. 7, f. 1.
Ophidion imberbe,	Linnæus; but he classes it with Jugular fishes.
Ophidium imberbe,	Bloch, Schneider, Pl. 90, but at page 486 he terms it *O. Chinense.*
Ophidie imberbe,	Lacepede. Pennant; vol. iv, pl. 93.
Ophidium imberbe,	Fleming; Br. Animals, p. 201.
" "	Jenyns; Manual, p. 481.

Rondeletius, who appears to have been the first who has noticed this fish, remarks that it is as much like a Conger as one egg is to another.

This little fish is so far one of the rarest in Britain, that it is only mentioned as having been found twice on our shores; the earliest of which was near Weymouth, and of which Pennant has given a characteristic likeness. The other was found by Montagu on the south coast of Devonshire; but some degree of doubt falls on it, since, when it died, which it did presently after being taken, it assumed a spasmodically distorted shape, very different from what is represented in Pennant's figure and that by Bloch as published by Schneider; the latter of which we have preferred to copy; since the prospect of obtaining a drawing from a recent example is exceedingly uncertain. But it is said to be of common occurrence in and near the Mediterranean, in no great depth of water; and we may add, that beyond this, little is known of its appropriate habits.

Montagu's example only measured three inches in length, but that which we have represented was five inches and three fourths; the shape generally like that of an Eel, but with the head less depressed. Eye large; jaws about equal; lateral line straight. Petoral fin rather large; in Montagu's figure the dorsal fin begins above the pectoral, but Pennant and Bloch agree in placing it back at about one third of the length of the fish from the snout. A yellow colour is so common to this fish, that it has been represented as among its specific marks; but as Bloch has not shewn it we have omitted it in our figure. This last-mentioned writer has also shewn a dark stripe as passing from the snout to the eye and superior portion of the gill-covers. Mr. Yarrell appears to have supposed that the likeness of this fish given by Schneider was copied from Pennant; but there are sufficient differences between them to shew that such was not the case; and that of the German naturalist may have been procured from an example obtained in the Baltic, where he says this fish is found; although it is not mentioned by Nilsson in his "History of the Fishes of Scandinavia."

MURÆNA.

The body lengthened, tapering behind; dorsal and anal fins uniting to form the tail; no pectoral fins; gill opening a small aperture on each side; barbs on the snout.

MURÆNA.

Muræna,	Jonston; Table 5, f. 4.
"	Willoughby; p. 103, Table G 1.
Muræna Helena,	Linnæus. Cuvier. Bloch; pl. 153.
" "	Yarrell; Br. Fishes, vol. ii, p. 406.

The principal interest which among us attaches itself to the Muræna is derived from the manner in which it was regarded by the ancient Romans, who, whether they viewed it as a delicacy for the table or as an object of amusement, and even of affection, are recorded to have carried their estimation of it to such an extent that Cicero felt himself warranted in saying that they paid more attention to these fish than to the interests of their country. Indeed the tales that are told of the manner in which the Murænæ were treated, and the expense employed in pampering them, could be rendered probable only by what we know of the force of fashion, and the reports handed down to us of the wide-spread profligacy and idle craving for amusement which had superseded the former characteristics of the Roman nobles, whose enormous wealth was formed of the plunder of the whole known world. We derive a chief portion of our knowledge of these particulars from the "Natural History" of Pliny, who says that C. Hirius was the first who formed preserve-ponds for these fish, which, however, were not kept for sale; for on the occasion of a triumphal banquet given by Julius Cæsar, when he supplied six thousand of these Murænæ to the feast, he gave it to be understood that he would be repaid only by the return of an equal quantity of these fish by weight. Pliny adds, his villa was of a very humble character on the inside, but when it was sold, in consequence of the value set on his ponds, it reached the price of four millions of sesterces (quadrigies.) A noble of the family of Licinius is said to have expended a large sum in forming ponds for fish; and we may suppose that the Muræna had a place in them, since he is said to have received an addition to his name on account of his love for it, although it should be observed that the name of Muræna belonged to a family of Romans long before this time. But former examples were outdone by Lucullus, who expended enormous sums in forming a passage through a mountain near Naples, to admit the water of the sea into his ponds; and so high was the value ascribed to this work, that after his death these ponds were sold for the same price as the villa and ponds of Hirius, the latter of whom was accustomed to expend the rent of his houses, which, according to Varro, amounted to twelve millions of sesterces, in food for his Murænæ. But, as far as regarded these fish, the labour of Lucullus in bringing the salt water might have been spared, since it is found that they will live and thrive in fresh water just as well as in the sea.

A choice of food, as also abundance of it, appears to have been of no small consequence in preparing these fish for the market, and it is known that they are eager in searching for it, as also that they are ferocious in their attack, as well as in self-defence, in which their teeth are so capable of inflicting injury by laceration as to have given occasion to the opinion among fishermen that some poison is connected with the bite. The voracity of the Muræna had indeed grown into a proverb among the Greeks, and the poet Æschylus couples it in this respect with the viper, its connection with the latter being the subject of some legends, of which an explanation is scarcely difficult. Aristophanes, in his comedy of the "Frogs," reckons his Tartesian Murænæ (from near Cadiz, whence, according to epicures, the best were obtained) as among the monsters that will tear the entrails of the wicked in hell. Even by respectable authority a wound by these teeth was judged a serious affair; and that eminent physician Paulus

Ægineta, is found prescribing equally for injury inflicted by the spine of the Fireflair Ray, the bite of the Muræna, and a wound from the Sea Scorpion—perhaps the Weever.

Scarcely anything came amiss to the appetite of this fish, but the Octopod or Teuthis was particularly a favourite prey, while the eagerness on one side, and fear on the other, were the occasion why in early times it was judged that there existed some instinctive animosity between them. The story of Vedius Pollio and the manner in which he fed his Murænæ is well known. He had been himself a slave, but had received his freedom, and was grown so rich and high in the world as to count Augustus Cæsar among his friends. On one unfortunate occasion, however, when the emperor dined at his house, a slave in waiting chanced to break a crystal vase of great value; and, conscious of the consequence, he hastened to throw himself at the feet of Augustus, with the anxious supplication that he might not be thrown into the pond to be torn in pieces by the Murænæ; an entreaty which led to further inquiry, by which it came to be known that such was the ordinary fate of offenders in this household. The emperor was so far impartial as to order that these ponds should be immediately destroyed.

And next after this, says Pliny, there sprung up an affection for individual fish, which, by kind treatment and feeding, were taught to know their master and to come at his call. Martial mentions this as witnessed by himself; and it was told of so eminent a man as Hortensius, that he shed tears on the occasion of the death of one of these favourites; and at the same villa the wife of Drusus was pleased to fasten earrings, we suppose near the opening of the gills of a favourite Muræna, a circumstance which attracted much attention from the fashionable world.

This fish is common in the Mediterranean, where it seeks refuge in caverns of rocks, and conceals itself, especially in the colder season of the year. It has many of the habits of the Conger, and at times has been said to quit its native element to come on land; a circumstance, however, which on inquiry Spallanzani found to be very rarely known, and only when urged by some necessity. It is retentive of life, but, as in the Conger, a smart blow on the tail effectually disables it, which a blow on the head will not. Mr. Lowe says it is not rare in Madeira; but we have not heard of more than one example that has been met with in the British Islands; and this was caught with a line on the 8th. of October, 1834, by a fisherman of Polperro; who placed it in my possession as soon as it was brought to land; and from this example our figure and description are obtained.

We learn that the ordinary length of this fish is about three feet; but our specimen measured four feet four inches; the body very flaccid, but plump, rounded anteriorly, compressed and tapering towards the tail; before the eyes the head is slender and pointed; jaws about equal, gape moderately large; the teeth long, sharp, incurved, prominent, in one row; a row on the palate; tongue adherent, scarcely perceptible; a nasal barb on each side of the end of the snout, another a short distance above each eye, and a probe passed down through the latter, found its way out at the former. Large mucous orifices encircle both jaws at equal distances, four on each row. Eye rather small, an inch and a quarter from the snout; irides light bluish grey, having a lively look; cheeks tumid, formed by the strong muscle which closes the jaw; an extensive depression behind this, at the side of the thorax, in which is situated the simple orifice of the gills, the outward appearance of which very much resembles a corresponding opening in the Lamprey; from the snout to this branchial opening six inches. From the part above the eye the head is much elevated, and the skin wrinkled; the thorax remarkably protuberant; the distance from the top of the head to the thorax five inches and three fourths. The vent is exactly half way between the two ends of the body; and from it proceeds a line to the end of the tail, parallel to the anal fin; which line must be the lateral, since there is no appearance of any other. The dorsal fin begins five inches and a half from the snout, and proceeds to the extremity of the body to join with the anal to form the tail. The anal begins at the vent, but both these fins are thick and fleshy, so as not to be readily distinguished from the general surface of the body.

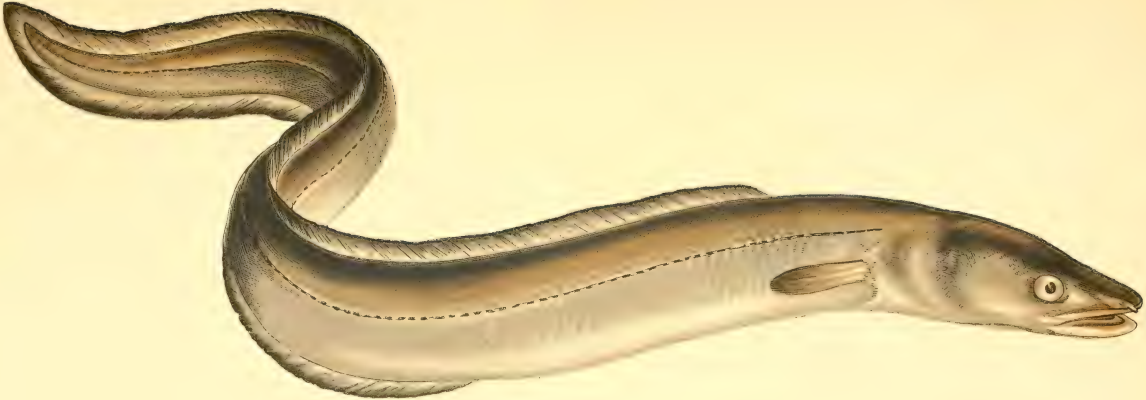
The ground colour of the anterior part of the body is a fine lively yellow, the hinder part fine purple; but the whole, including the fins, is divided into segments which form irregularly-shaped spots, which yet shew a tendency to regular distribution. Towards the tail the yellow spots more resemble irregular rings, with larger spaces between them; the whole interspersed with innumerable spots of whitish and deep yellow, golden, brown, and purple, forming a very beautiful arrangement. Under the throat and to the opening of the gills a few lines are marked on the skin, as if to facilitate motion, although the skin is exceedingly smooth and soft; it is strong also, and the colours were remarkable slow to fade. This example shewed great strength after it was taken on board the boat.

CONGER.

Conger,	Jonston; pl. 4, f. 7.
"	Willoughby; p. 111, Table G 6.
Muræna conger,	Linnæus.
Murène congre,	Lacepede. Donovan; pl. 119.
Conger vulgaris,	Cuvier.
" "	Yarrell; Br. Fishes, vol. ii, p. 402.
Anguilla conger,	Fleming; Br. Animals, p. 200.
" "	Jenyns; Manual, p. 478.

The Conger is one of the commonest fishes in the sea that flows round the United Kingdom, from the border of the tide to at least a depth of fifty fathoms; but we have no evidence to shew that it has ever wandered into fresh water, although the large size, even above sixty pounds, which has been ascribed to an example of the Eel, already referred to, might lead to a suspicion that such has been the case. It is not numbered by Fabricius among the fishes of Greenland, but it is found along the coasts of Europe, and in the Island of Madeira, as also in the northern states of America; but those of the Mediterranean are said to be smaller than such as are met with in the open ocean.

Congers appear to have favourite haunts, from which few of them wander far; but there are times, according to the seasons, in which they are more abundant than at others, and it has been noticed that in November and December those of a black colour, which always keep near rocks, are in abundance, so that a fisherman who fishes nearest the rocks is the most successful; at which time we suppose the assembling to be for the purpose of depositing their spawn. But it may be caused also by the varying habits of inertness and activity to which they are liable according to temperature, and especially as they are influenced by the direction or violence



1.—CONGER. 2.—MORRIS.

CCXXXVIII

of the wind. In simply cold weather they are less eager for food, and seem to be inert; but when the cold is severe, and especially when it is sudden, there are instances of its having proved extensively destructive. On one occasion in the month of February, during an east wind, which had driven the water from the north into the British Channel, large numbers of these fish were found floating on the surface, altogether helpless, although not dead; and under similar circumstances, on the north coast of Somersetshire, in another year, a large quantity were found to have been killed, while at the same time in a situation where they were more effectually sheltered, Congers were sufficiently active to take a bait. Mr. Thompson relates occurrences of a similar sort on the coast of Ireland; and it is scarcely uncommon in the more southern climate and deeper water of Cornwall, where fishermen report that in severely cold winters large numbers have been thrown on shore or left by the tide. Without being dead, these fish appear as if blind, and they are thus found more especially if a south wind springs up presently after a cold wind from the north east, which, however, may have this effect only because it blows directly toward the shore. It is remarked by fishermen that before a storm, especially when the wind is south east and west, Congers are more than usually active; and it is their belief that if fishing could be carried on in a stiff gale, more of these fish would be taken then than at other times.

But as these fish are quickly sensible of changes in the wind or weather, and even appear to anticipate it when at a considerable depth, if a little time is allowed them they seek their usual places of shelter, which are often among rocks near the land, and in the hollows of which they are not unfrequently left for an hour or two by the tide. There are some also which keep in what is termed clean ground, where the bottom is soft, or formed of sand, and in which they seek safety and comfort, although not seldom to their own destruction; for where the tide ebbs to a large extent, so as to leave much of the beach uncovered, people acquainted with these habits of the fish are accustomed to discover them by trampling on the ground, and then to dig them up. Fishermen are able to distinguish such Congers as live on rocky ground from such as keep on the plain and open surface; for it is found that even those which are met with in a narrow stripe of sand, and more decidedly those which inhabit a wide and open space, are of a light colour, and even white, while the inhabitants of rocks are decidedly black, and near the rocky land intensely so. There is a well-known rock on the coast of Cornwall, about five leagues from the land, and standing up from the plain ground which spreads to a large distance round it. The top of this rock is full of gullies shaded with weeds, and Congers which are caught on it are always black, while close to its base these fish are always white.

It is only by night that these fish display activity, and even moonlight will interfere with the success of the fishery. Their appetite is variable, but at times voracious, and they exercise delicate choice in what they devour. It is supposed that they give a preference to prey which is of a brilliant colour, and they are eager after what is alive or but very lately dead, while a bait that is tainted will not be successful. They are sufficiently sly or nimble to obtain Soles and Plaice, and make no scruple of devouring young ones of their own kind. Skulpins and even the well-armed Weevers are often found in their stomachs. Fish of larger size are also their prey; and an example of no unusual size was found to have one that weighed ten pounds in its stomach. I have taken a lobster of the largest magnitude from the stomach of a Conger; and one of fifty pounds was found to have seized a Hake which weighed four pounds, which it had laid hold of high in the water, up which they sometimes have mounted to a depth of seven or eight fathoms over the sounding of fifty fathoms. Pilchards, Herrings, and Cuttles are at all times successful baits; and in our description we shall point out the organization of the sensations of this fish, so as to shew that it is well qualified to exert great skill in the selection of its food. Digestion is very speedy, and when a hook is swallowed it becomes acted on and consumed in a very short time.

The manner in which these fish were propagated lay long under the veil of obscurity, as was the case with the Eel, and for the same reason; but examination has shewn that the milt and roe are placed along the course of the dorsal portion of the cavity of the body, as in the kindred fish; and although the grains may be shed through the summer, we only feel confident of them in the autumn. Mr. R. Q. Couch remarks, in the "Zoologist," that he had seen cases where the ova were as large as small peas; but as this is rare, and in general they are very minute, the rapidity of their development at last must be rapid. And a friend in the west of Cornwall has informed me under the date of the 30th. of December, that about two months before he caught in a trammel-net in Helford Harbour a large quantity of curiously-formed stuff, which an old fisherman pronounced to be weed. But it appeared to the observer to exhibit more evidence of design and regularity than are usually discovered in sea-weed; and on examining the masses there were found a young fish much resembling a Conger in each of the diverging globules, which in form were an elongated ellipse. The growth of these young ones is not slow, but several years must pass before they reach the size at which they are sometimes found.

In every part of its body this fish possesses great muscular strength and agility; and these it puts forth in a manner that is highly characteristic when the object is to deliver itself from restraint. When taken on board the boat and left undisturbed, the sensitive powers of its tail are employed in searching out the nature and limits of its prison; and then this organ is stretched out to lay hold of the gunwale; by fixing its holdfast on which a reversed muscular contraction is put in force, and the whole body is turned overboard; to prevent which, however, when the fish is first taken, it is usual to inflict a smart blow with *the bat* or bludgeon on the root of the tail, or on the vent; either of which is effectual in disabling the victim. But again, if the hungry fish has had the mishap to have found its way into a crab-pot, the method of escape is with some amount of difference, although the tail is still the instrument employed. Thrust between the upright willow rods, they are thus pressed asunder to allow of the reversed muscular action of the body, and at last of the passage and escape of the head. A further and somewhat different proceeding is the resource when the fisherman's hook is fastened in the jaws; and a revolving action is particularly successful when the line is of the sort termed a bultey or long line, already described; and especially when also the fish is in an early stage of growth; for fishermen report that this method of deliverance is less frequently employed by the older fish. As soon as the restraint is felt the revolving motion begins, by which the shorter line is twisted into a ball, with a force that is often sufficiently strong to wrench the hook from the jaws. It may happen, however, that in its repeated turning the body of the fish itself has been bound into the same ball with the line, and the intention is defeated by the same means that were adopted to secure it.

Nor are these the only occasions in which this singular sort of motion is put in force; and it becomes not a little formidable if brought to act upon the human hand which has found its way into the fish's mouth; of which an instance has been long remembered in personal experience. Fortunately the Conger was not large; and it had been left by the tide in a cavity beneath a rock, into which there was scarcely room for the hand to be introduced, to draw it out. But in attempting this the thumb was grasped within the jaws of the fish; on which the instinctive motion immediately began, so that the teeth were made to act like a saw round the circumference of the thumb; and it was only by a sudden and violent jerk that the flesh was preserved from severe laceration.

A fisherman had safely taken a stout Conger into his boat, when the fish snapped at and caught his foot within its mouth, and sprang overboard, carrying his shoe with it. In another instance, where the fish was of large size, the result was rather amusing than formidable; but the lesson to be taught is that there is danger in incautiously meddling with these fish. A man had thrust his foot into the mouth of a Conger that shewed little signs of life; when suddenly the jaws grasped it, and an active revolving motion began by which he was dashed to the ground with considerable violence. Mr. Thompson has adduced instances where even the jaws of the separated head have closed on and bitten the hand and foot of those who have meddled with them; and the continued vitality of this fish in all its parts after the head has been cut off is well known. But it is even more remarkable that if the brain be pierced on a limited portion of the hindward part of the head, this fish dies immediately, without a struggle; and in explanation of this experiments have shewn that the most vital portion of the brain (encephalon) extends from the part termed *pons varolii* along the whole course of the spinal cord, as far back as the second cervical nerve; in any portion of which a wound is instantly fatal; whereas behind this point or above it, nearer the brain, the effect of a wound is gradually less dangerous. (Forbes' Med. Review, vol. i, p. 560.)

As an article of food much difference of opinion exists in different places concerning this fish; for while rejected as worthless, and even with abhorrence, in Scotland, in the west of England it is valued and made a principal object of the fishery. Nor is this high opinion a matter of modern date, since we are informed that in the fourteenth century it was admitted as a chief dish to the tables of the highest nobility, and it was reserved as a chief rent in the underletting of land. With us at present it is purchased by the agricultural population; and much value is set on the milt and roe, on account of the fat in which these organs are embedded, and which, from the absence of all rancid or disagreeable smell and taste, is employed in select cookery.

There was an established trade in the west of England for a special preparation of this fish in the time of King John; for we are told that, following the example of his Norman predecessors, at the small price of six marks he assigned to certain merchants of Bayonne, the same who already possessed the sole privilege of the Whale fishery, the monopoly of the right of drying Congers and Merluciones, or Hakes, in this country; and this, as regards the Congers, we consider to have been what in times not long past, was known as Conger doust or douce, (sweet Conger;) the exportation of which was to Spain, and perhaps to Portugal; but which ceased on our part from a falling off in the abundance of these fish; and in Spain, as we have been informed, from deficiency of sale. The fish selected for this preparation were of the smaller size, and were cut flat through their length, so as that they might be sewn together by their edges, to form a sheet. They were then hoisted on a frame-work, without salt, until the fat had melted, dried, or taken flight; and in this state they were grated into soup in the countries to which they were sent. Dried Congers were also prepared in France; but with a better contrivance, the minute creatures (mites) which are bred in stale wheaten flour were employed to feed on, and so remove the oily particles, and hasten the drying.

But the fishery for Congers has been becoming more unsuccessful for several years; as, in the west at least, has been the case with those other kinds which are usually taken with the line; and the circumstance can only be explained by the belief of the evil influence of the repeated tearing up of the ground on which, in the deeper water, they are bred. It has been not uncommon for a boat with three men to bring on shore from five hundred-weight to four times that amount; but a much less quantity is more recently considered a favourable adventure, and those also considerably less in size; as regard which at a distant date I possess a note of an example that weighed one hundred and four pounds, with others of eighty-six and ninety. This last-mentioned fish was in length seven feet two inches, with a girth of twenty-seven inches; and another, which was of the more ordinary weight of fifty-six pounds, was eight feet in length, and in girth about two feet. The general form is much like that of the Eel—long, slender, round anteriorly, flattened towards the tail. The head widened at the hinder part, narrowing forward to the snout, which projects over the lower jaw; temporal muscles close together on the top of the head; the space from between the eyes to the snout arched over; three plaits in front, and on each side of them a short, flat, blunt barb, having an aperture; a single round open nostril on the border between the plaits and the barb. Eyes level with the surface, large and bright; lips fleshy at the sides; a single close-set row of teeth in each jaw, and a bed of them in front of the palate. Gill openings small, in front of the pectoral fins, and a little below the line of their root; lateral line straight, dotted through its length with a row of white points. The single dorsal fin begins nearer the head than in the Eel, being only a little behind the border of the pectorals; the anal runs from the vent to join it in forming the tail; pectorals round. The colour almost or altogether black, except the belly, when living on rocky ground, lead or cream-coloured when on sand or open ground.

An abundant distribution of nerves to the mouth, lips, barbs on the upper lips, folds, and single nostrils, is the cause and proof of the exquisite sensibility of these parts in their various functions; and the tongue admits of free action by means of muscles which pass from it to the front, and also backward to the beginning of the gullet. The stomach is long, but the pyloric or lower orifice is near the entrance from the mouth; air-bladder large, inflated, but not the full length of the cavity which contains it; a duct or process from the surface is joined to it, but its use scarcely appears obvious.

This fish is liable to some remarkable varieties of structure, among which has occurred a deficiency of the upper jaw bone or snout, with the absence of the nasal plaits and barbs. But a more frequent deformity is in the dorsal fin, which sometimes begins far back, with its anterior end twined into a roll or double circle; and on other occasions this fin is absent almost as far back as the tail; which appears to have been the cause of a mistake in supposing the *A. myrus*, or Ophis, natives of the Mediterranean, to have been taken in England. When, as sometimes happens, the tail ends abruptly, it seems to have been caused by violence or accident.

LEPTOCEPHALUS.

The head small, without barbs at the jaws; body lengthened, very thin, and so transparent that the inward parts may be easily distinguished. Gill openings a little cleft, not a mere aperture. Vent not before the middle of the body; dorsal and anal fins joined to the tail, so as to form one fin.

MORRIS.

Leptocephalus Morrisii, Jenyns; Manual, p. 840.
" " Yarrell; Br. Fishes, vol. ii, p. 409.

This fish has obtained its name from the gentleman who was the first to make it known, and in part also as the Anglesea Morris, from the neighbourhood where the example was taken; but the earliest description and figures were so imperfect that they cannot be referred to as authority. Since, however, that special notice has been directed towards it by the repeated instances of its having been met with, it has been found to be scarcely rare round the whole extent of the British coasts, even to Caithness, where an example was obtained by Mr. Peach. Many have been found in Ireland and the south coast of England; and it is mentioned among the fish of the Cape of Good Hope by Dr. Paape; if indeed the species be the same; for Cuvier remarks that there are other species of this genus in more southern climates. On the coasts of France and the Mediterranean it is not uncommon; and with us is sometimes left by the tide in a pool on the shore. There is no doubt that its usual residence is in shallow water and rocky ground, but it also inhabits the deeper water, up through which it mounts, with no little danger to itself from the prowling wanderers of the ocean, to which it seems a tempting morsel, and often falls a prey. An instance has been known where the fish had already seized the hook, and when drawn on board, a Morris was found, loose and alive, in the mouth, as if only just then grasped at and seized. In the water its motions are slow and undulating through its whole length; and it is noticed that where they begin the action at first is near the head, and it proceeds backward through its length.

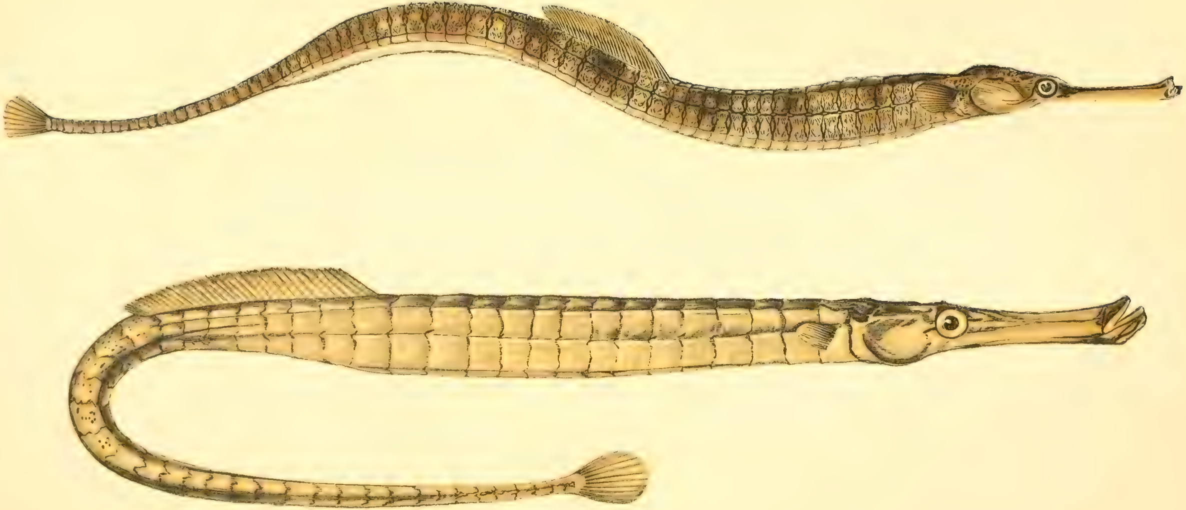
As there is only one known species of this genus in the seas of Europe, a description of this fish will practically serve for that of the genus itself; but in the several examples that have passed under our notice there have appeared differences which tend to shew that the fish itself is subject to some variety, or perhaps that in different examples there are portions of its character which are in these instances brought more prominently into view. It is retentive of life.

The appearance of this fish when alive represents a thin ribbon of transparent jelly, and the only opaque portion is the eye, which appears like a circular plate of brilliant silver. A mutilation of the head in the original specimen was the occasion of the generic name, but this part is not disproportionally small; the jaws equal; no teeth in the upper jaw perceptible, in the lower jaw a single row regularly placed; six orifices of mucous glands along each side of the lower jaw. Length of the fish six or seven inches; in a single instance the back was raised close behind the head; the depth of the body increasing behind the vent, which is about the posterior third of the length, and after this tapering to the tail. An usually well-marked lateral line, with indentations, (apparently for ribs,) straight; and from the thorax back a line, usually marked with a row of minute dots, to the tail. A well-marked pectoral fin. The dorsal begins at about one third of the length, and joins the anal to form the tail. In a living example I have counted the spinous processes of the vertebræ one hundred and fifty-two in number; the brain appearing opaque, like pale milk, the *medulla oblongata* (proceeding from it) rising and passing off backward near the summit; but no further appearance of a nervous system was discerned. Although the general appearance of this fish is singularly without colour, some exceptions have been noticed: in some instances there was a dark band across the forehead from eye to eye; and again a general faint tinge of bronze over the body; silver-like marks at the ribs, which became bluish towards the tail.

PIPEFISHES, OR SEA ADDERS.

SYNGNATHI.

A CHARACTER of this remarkable family of fishes is, that in front of the eyes the snout is lengthened into a tube, at the end of which is the mouth; which is small, with the angle depressed, so that the lower jaw closes on it like a cover. Gill-cover formed of a bony plate, with a small opening to the gills high on the side; the processes or aerating fibres of the gills divided into small round tufts, that are arranged in pairs along their supporting arches. It is from this structure that Cuvier terms these fishes *Lophobranchiati*, or having tufted gills. The body is covered with regularly arranged plates, which tend to produce an angular appearance through its length.



1. GREATER PIPEFISH. 2. BROAD-NOSED PIPEFISH.

CCXXXIX

SYNGNATHUS.

In addition to the general characters of the family given above, this genus has an elongated body; pectoral, dorsal, and caudal fin, and a slight anal or ventral; in the male a pouch behind the vent, marked by a longitudinal slit.

GREATER PIPEFISH.

GREATER SEA ADDER.

Syngnathus acus,	LINNÆUS. CUVIER.
" "	FLEMING; Br. Animals. p. 175.
" "	JENYNS; Manual, p. 484.
" "	YARRELL; Br. Fishes, vol. ii, p. 433.

Rondeletius gives characteristic likenesses of *S. acus* and also of *S. Typhlè.*

THE singular conformation of these fishes, with some peculiarities of their habits, and especially their manner of producing their young, have been noticed from remote ages; but of the particulars of the last-named proceeding the most erroneous opinions continued to be held to a very recent date. The naturalist Pallas ventured the opinion that each individual was possessed of a community of sexes; and in Schneider's edition of the remains of Bloch, he arrives at the conclusion that all the individual examples known were females; so that the males of the present species and, we suppose, of the wide-nosed, next to be described, were yet to be discovered. But a generally received idea among naturalists was the pardonable one of the confounding one sex with the other; to which was added a large amount of uncertainty as regarded the actual proceeding in the evolution of the young.

Aristotle had observed of the fish which he called Belonè, that there was a cavity on the lower part of the body behind the vent, of what he believed to be the female, which at the proper season was rent asunder in order to allow the escape of the young; and the consideration of this supposed fact of the disruption and its consequences has produced in Lacepede an expression of poetic sympathy, in which he dwells on the self-sacrifice which this fish has shewn itself thus ready to make for the sake of its offspring. But later observation has rectified much of the error into which the older naturalists had very naturally fallen; and has thus made the proceeding of the production of its young intelligible; while in fact the singularity of the process is rendered even more remarkable than formerly it was supposed to be.

The species now under consideration, together with the Broad-nosed Pipefish, are in truth what is now known by the term Marsupial animals; but with this difference from the quadrupeds thus designated, that in the present instance, while the first production of the eggs or roe is in the body of the female, (in which sex no caudal pouch exists,) at the time of their being rendered fertile, they are transferred to the male, which only possesses a pouch, and in which they pass through the further stages of their development, until they have become duly qualified for the duties of active life in the sea. Before impregnation the slit which forms the entrance of the pouch is sealed by adhesion, and so it becomes again when the eggs have been received into it, although, as we shall see, this is not usually a single proceeding, once and for all.

Mr. Jenyns found these fish with enlarged roe when only four inches in length; but our observations are from individuals of mature growth, in which still a portion of the actual proceeding in the transferrence of the grains remains obscure; but it is thus briefly referred to by Mr. Andrews, of Dublin, in the "Zoologist" for 1860, p. 7052:—"In shoal-water or a low tide these fish may sometimes be seen in pairs side by side, apparently stationary on some rocky stone. At this time the ova—the capsules but imperfectly matured—are liberated from the female, and received into the abdominal sac, the male fish having the power of expanding the lappings of the sac, and attaching the ova by a highly viscid or glutinous secretion."

Rondeletius found ova in the pouch so early in the year as the beginning of winter, and on further search he discovered that there had been three separate deposits, so that while some were in one portion of the pouch almost fully developed, the latest barely displayed the existence of the eye and the snout. Yet such is not always the case, and perhaps not often; and the following are the notes of my own examination; with the additional remark, that the pregnancy has been found so late as the month of September; although it has not extended into October. When, in April, the pouch was found filled with ova, the edges of the slit or opening were united together by thin fibres, as they were before any had been received. The grains were then all closely fastened together by a covering membrane, and also attached to the walls of the pouch both at the sides and back, but not in front; and each one lay in a cell, the borders of which passed across, with scarcely a mark longitudinally. Each egg was formed of a transparent fluid, and on one side was a red mark in distinct grains of different sizes, in small proportion to the whole bulk. As the grains lie in the pouch, this red spot is in every instance directed towards the opening; and on a short exposure to the warm sunshine the whole substance became solid without shrinking. When further grown the body of the fish is seen curved into a circle, and the head projecting with a short snout in the middle. At a still further growth the ovum remains attached to the body; but even when fully developed a kind of attachment still continues between the parent and the young, for in case of alarm they fly again to the shelter of the pouch, and are readily received into it.

While searching for food among the overhanging weeds and crevices of rocks and stones which they frequent, every attitude is adopted, with the head up or down in each kind of the perpendicular, and with much contortion; while the snout is thrust into the chinks where the prey is likely to be met with. The food generally appears to be the smaller kinds of crustacean animals; but not unfrequently shrimps of comparatively no small size are swallowed; and there have been found in the stomach some so large as to raise our wonder how they could have been made to pass between the jaws and through the gullet; and it is only the remarkable structure observed in these parts that will explain the possibility. This structure is complex in a very high degree, by an arrangement of jointed bones, muscles, and elastic ligaments; by the action of which the long bones which lie along the under part can be separated so as to enlarge the space between them to nearly twice its ordinary extent; with a corresponding action on the true jaws; while another portion of the mechanism lays hold of the substance to be swallowed, and passes it backward into the stomach.

This fish is retentive of life; and its usual haunts are in harbours or bays; but fresh water appears to be hurtful to it. It is sometimes found also in the open sea at the depth of several fathoms, and often passes through such from one harbour to another.

The usual length is about a foot or fifteen inches, and it is two inches round at the thickest part; the snout lengthened, rather more than an inch before the eyes; and to the firm portion of the gill-cover there is one seventh of the length of the body. Mouth without visible teeth. Eyes large, nostrils close before them. The head rises above the eye, and is there flat; the nape formed of two elevated plates; plate of the gill-covers large, oval posteriorly. Body lengthened, in the female tapering behind the dorsal fin, in the male behind the marsupial pouch; covered with a series of plates, which are twenty to the vent and from thence forty-four to the tail; forming angular lines which become more decidedly marked after death; six, or including the ridge of the back, seven to the hindmost border of the dorsal fin, and beyond this the body is square. The vent below the first rays of the dorsal fin. The pectoral fin broad, with twelve rays; the dorsal with forty-one or two; the tail round, ten rays; anal or ventral six. Colour rich yellowish brown, often in bands of lighter and darker.

An irregularity of formation has been observed in this fish, which might almost lead to the idea of a separate species. Instead of the usual shape of the tail with several rays, there were only two firm rays united by a narrow and slender membrane; and the ventral fin was small, with only two rays; but there were no marks of violence.

I find the air-bladder of this fish of curious structure; the anterior half being obscurely transparent, ending in a defined line, and the remainder altogether clear; these two portions being separated by a membranous septum, as if their functions were altogether different.

BROAD-NOSED PIPEFISH.

Typhlè,	RONDELETIUS.
Acus Aristotelis,	WILLOUGHBY; Table I 25, p. 158.
Syngnathus Typhlè,	LINNÆUS. CUVIER.
" "	FLEMING; Br. Animals, p. 175.
" "	JENYNS; Manual, p. 485.
" "	YARRELL; Br. Fishes, vol. ii, p. 438.

THIS species has been confounded with the former; from which it is readily distinguished by its much broader expansion from the eye to the jaws, and the larger capacity of its mouth. The angles of the plates of the body are also less definitely marked, and the structure of the plates less firm; but the general proportions are nearly the same, except that the top of the head is less elevated. Its particular habits have been less observed than those of the former species; but although in some districts common, it is not generally distributed. It is in truth a local species, although as regards the range of climate this and the former appear to be equal. None of the family are found in Greenland, but these are common among Scandinavian fishes, as also in the Mediterranean. Willoughby found it abundant at Venice.

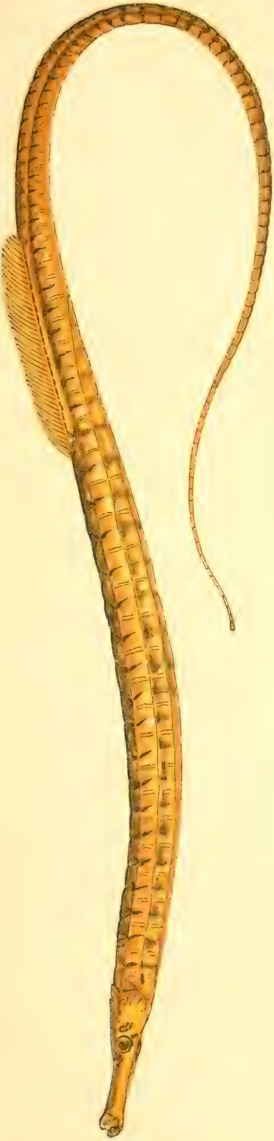
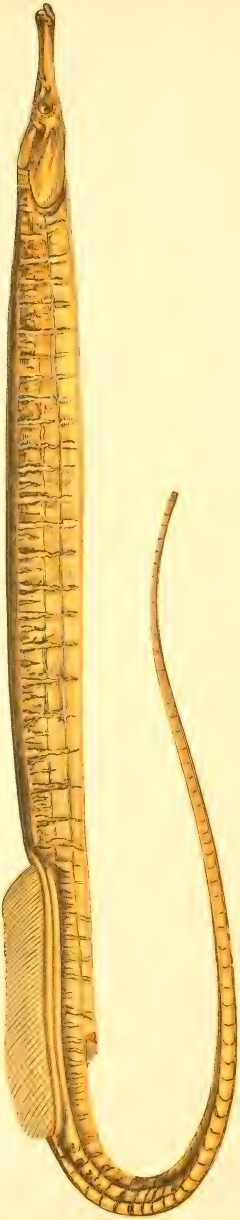
This fish grows to the length of about a foot, or a few inches beyond; the line of direction almost straight from above the eye to the dorsal fin; which is proportionally further back than in *S. acus;* but this dorsal line is marked with small elevations formed by the plates; which are in number eighteen, and from thence to the tail about thirty-five. The body becomes more slender from the dorsal fin backward to the tail. Pectoral fin small, with thirteen rays; dorsal thirty-five; caudal round, the rays ten; a small anal fin. The colour a light yellow, with little variation.

[We place in a separate section or genus, but without assigning to it a separate name, species which have a much more lengthened and comparatively slender body than those of the proper genus *Syngnathus*, with a true although very small caudal fin, but without pectorals, anals, or a pouch to receive the young; which latter circumstance we think of sufficient importance of itself to warrant the separation.]

OCEAN PIPEFISH.

Syngnathus æquoreus,		Linnæus. Cuvier.
"	"	Jenyns; Manual, p. 436.
"	"	Yarrell; Br. Fishes, vol. ii, p. 442.

This species is more especially an inhabitant of the open ocean, where in summer our fishermen report that they see it near the surface over a depth of more than fifty fathoms, at a distance from land of ten or fifteen leagues; and generally its coming near the shore appears to be by accidental wandering rather than from design, and on this account it has been believed to be more scarce than it really is. The only exception to these remarks that I have met with is from Mr. Andrews, already quoted, who says, ("Zoologist," volume for 1860,) "In Dingle Harbour the *S. æquoreus* may be met with very abundantly in the summer months, spawning in the months of June and July. This is the largest and most beautiful of the species, the girth of the body being oval, of a long tapering form to the tail. These fish under favourable opportunities of calmness and of tides, may be seen side by side, clinging with their tails to the tufts of *Zostera marina*, in which position the male is enabled to attach to the abdomen the ova by the same influence of viscid secretion alluded to in the marsupial species:" or, as I shall prefer to express it, by the combined action of both parents the ova are transferred from the female to the external surface of the male, from the

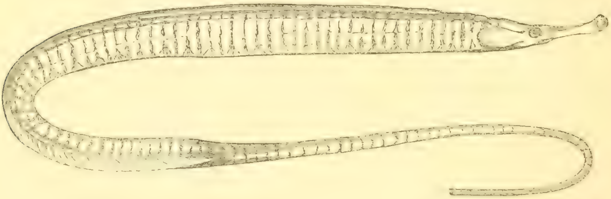



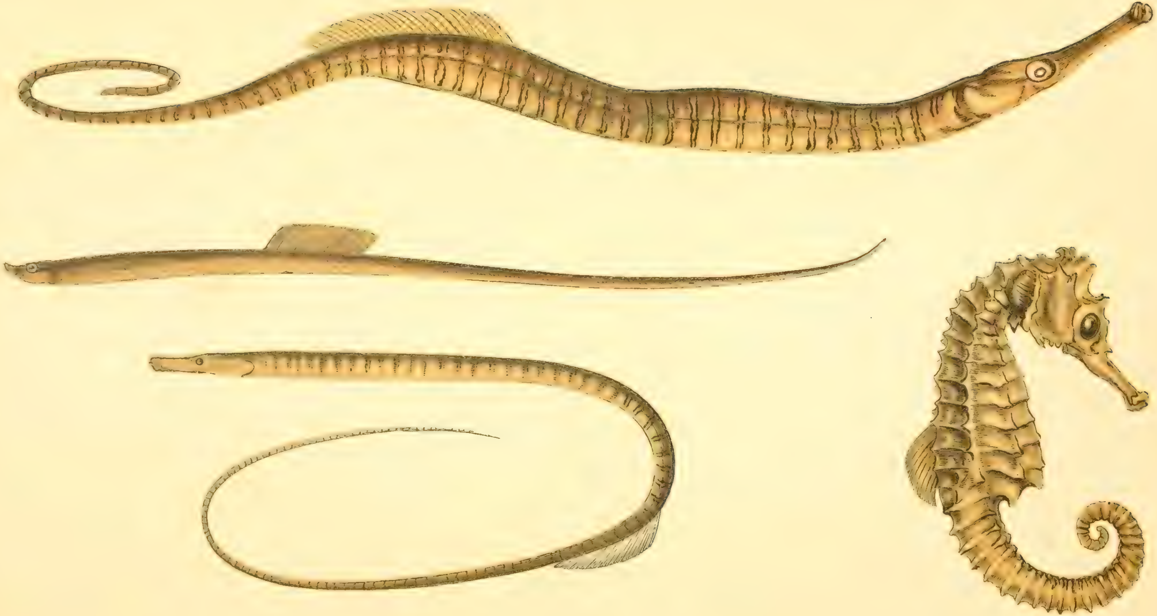
vent forward, where that part is flattened for the purpose of sustaining them until they become developed into life, but of which some of the particulars have been better observed in the species next to be described. Mr. Andrews adds, "I have noticed *S. æquoreus* greedily stripping the stems of *Zostera marina* of the young of *Anthea cereus,* which were attached in a semiglutinous state."

What I have considered the Ocean Pipefish has been met with under such considerable difference of structure as to raise the supposition that if the variation is not to be ascribed to accident or monstrosity, it must be the mark of a distinct species hitherto not known among British fishes. On this account it is judged proper to give a separate description of each of these supposed species or varieties, with characteristic figures, by means of which a further inquiry may enable an observer to decide the truth of the matter.

It was in July, which is the season when these and the kindred fish are most commonly and abundantly seen, that an example now to be described was thrown on shore in a storm; and on examination it proved to be a female with fully enlarged roe. It measured twenty-two inches in length, where deepest measuring an inch; the body much more compressed than in the other known kinds of British Pipefishes, and which is the acknowledged character of the Ocean Pipefish, but scarcely or not at all angular from the dorsal to the ventral ridge; the plates not to be counted when the fish was newly from the water; but the perpendicular lines numbered fifty-eight, the first obscure, the second crooked, and the order continued more than an inch beyond the vent. It was found that two of these lines answer to a single plate. Above the eye less elevated than in the *S. acus,* rising above the gill-cover; from the snout to the hindmost border of the eye an inch, and to the border of the gill-plate an inch and seven lines, to the vent less than half the whole length. Two thirds of the dorsal fin before the line of the vent, with forty-two rays; but what especially marked this example, in common with that one presently to be described, and differing from all other of our known species, was (in this case) a narrow membrane, which ran along the ridge of the back to near the dorsal fin. In the present instance this dorsal ridge suddenly fell as it approached the fin, and began again behind it, more rounded, and gradually disappearing along the caudal portion, with a depression or channel along each side of the base of the fin. The ventral ridge was slight, and the only mark of an angle was slight along the side, bending down and ending at the vent; behind this point round, tapering and ending in a small but well-marked fin, with five rays. The colour yellowish brown, dark along the dorsal ridge, belly yellowish; a brownish pink stripe from each side of the upper jaw through the eye to the upper border of the gill-covers.

I have possessed a male of the acknowledged Ocean Pipefish which in length measured twenty-six inches, and a female but little short of the same dimensions; but there was a remarkable difference in the structure of both of them from that given above. They were more slender, and the female especially so. But the more remarkable difference was in the ridge along the back to the dorsal fin, which has, from near the head backward, a membrane almost as broad as the dorsal fin itself, and the line of direction passed on straight to the extremity, without that gap or depression in which the dorsal fin was situated in the first-named example. In the latter also the tail portion ended without a distinctly visible fin, in this respect having some resemblance to the species coming next under our notice, and of which I shall make a comparison with the Ocean Pipefish; but this defect may have been the result of accident.





1. SNAKE PIPEFISH. 2.—WORM PIPEFISH.

3.—STRAIGHT-NOSED PIPEFISH. 4.—HIPPOCAMPUS.

CCXLI

SNAKE PIPEFISH.

Syngnathus ophidion, JENYNS; Manual, p. 487.
" " YARRELL; Br. Fishes, vol. ii, p. 445.

THIS is not only a common fish at some seasons, but at times it abounds in incalculable numbers from near the shore to several miles in the open sea; and it is then they appear to perform a perhaps limited migration or change of quarters; for they swarm at the surface in fine weather from the early part of summer to its declension; but after this time they are not seen, and probably have gone to the bottom, and into deeper water. When on our coast their actions are amusing, as with their slender and prehensile tail they lay hold of some loose and floating object; with the aid of which, and the anterior portion of the body free, they steer their wandering course by the waving action of the dorsal fin. A slip of floating sea-weed, a rope, the mark line of a crab-pot, or the entangled meshes of a net, will serve them for support and rest, and thus they are kept at the surface with little effort; but they are liable to be devoured by ravenous fishes, and the stomach of a Pollack has been found filled with them.

The line of the under part of the body of the male, from the vent forward, is, as in the Ocean Pipefish, the place where the ova are affixed in something like order; and there appears to exist in that part a tendency to organization, which is brought into exercise on this occasion; for it is certain that there is something more than a mere adhesion of contact between the grains of roe and the surface on which they lie; since the skin is raised round each of the grains like a cup, and they are not easily removed from it. Within the female when procreant, the slender pair of ovaries exceed three inches in length, and connected with these I have observed to hang loosely from the vent a membranous tube, an inch and three fourths in length, of which I suppose the use to be the distribution of the grains of spawn.

Allowing for a considerable difference of size, there is considerable likeness between the Ocean Pipefish and the present species; and yet even at first sight they are readily distinguished; since the compressed form of the former is very different from the rounded shape of the body of the latter. The presence or absence of a very small tail is less to be depended on, as I have known it absent, perhaps broken off, in the Ocean Pipefish, but the presence of a thin membrane, more or less broad, is a conspicuous feature in the last-named fish; and their relative proportions are very different. In the Ocean Pipefish the middle of the length is at the first fourth portion of the dorsal fin, and considerably in advance of the vent; while in the Snake Pipefish the middle of the length is more than the same proportion behind the vent. From the vent to the slender extremity is about one portion and a half of the distance from the vent to the snout. The origin of the dorsal fin is at one third of the whole length, and the middle of the body is behind the whole of this fin. The colour of this fish is a pale yellow, with sometimes a pink line from the eye to the snout.

WORM PIPEFISH.

Acus lumbriciformis,	Willoughby; p. 160.
Syngnathus lumbriciformis,	Jenyns; Manual, p. 488.
" "	Yarrell; Br. Fishes, vol. ii, p. 450.

In its habits this little fish differs from all others of its family; and while one of the most common, it also appears to be the least numerous; perhaps with the exception of that one which is next to be described. Observation seems to shew that it is not able to raise itself above the ground; on which it creeps in its endeavours to escape being caught, with a serpentine motion much like that of the slow-worm. It is commonly found near low-water mark, where it seeks shelter under a stone, more frequently singly, but sometimes in a company of several together. There is no proof that it ever goes into the deeper water. In summer the grains of roe are found arranged along the under portion of the body of the male from the vent forward, as in the other species of this section of the family; but not always in very regular order; and they are held fast by a rising round each of the skin of the parent; but there does not appear to be any organic or vascular union between them.

We copy some interesting observations that were made by the Swedish Professor Fries, on the curious phenomena displayed in the development of the young of this species; and which perhaps may be found to apply to others of this genus or family. It appears then that at the time of their escape from the egg the tail is covered with a fin-like membrane, which extends some way up the back and along the lower surface to the vent; and there are also pectoral fins; but subsequently these disappear, except that portion which forms the dorsal fin, the process appearing to be, that these apparent fins cease to be nourished, and therefore shrink into nothing in the same manner as the tails of frogs are known to cease to exist. The gill openings are large and not bound down by membrane.

This fish does not exceed five or six inches in length, the body round, and of much less size than an ordinary quill, tapering to a point from the vent to the extremity; smooth, and with little appearance of separate plates. Eye near the top of the head, the snout turned upward in something of an arched form; nostrils close in front of the eye. The colour is various in different examples; in some quite black, with a row of pale whitish spots along the back, which near the head are distant from each other, but closer together near the tail. In some the colour is of various shades of brown, the cheeks mottled with defined patches of pale yellow; which are also on the first plates of the body; lines, which appear to separate the plates, punctured with dots of pale blue.

STRAIGHT-NOSED PIPEFISH.

Syngnathus ophidion, YARRELL; Br. Fishes, vol. ii, p. 447.

THIS is a species by no means common, and of which little is known of its history. In appearance it is not greatly unlike the Worm Pipefish, but it is larger, and in other respects the differences are easily seen. It is about equally slender, and even more so towards the end of the body; but instead of being bent up, the snout projects straight before the eye. The dorsal fin is further back, its place being about the middle of the length, and there is no other fin; the plates on the body more distinctly marked, and thirty of them may be counted before the vent, with about twice that number behind it.

HIPPOCAMPUS.

The body is compressed at the sides, and elevated much more than the portion behind the dorsal fin, which portion becomes gradually more slender to the end. The joinings of the scales are raised into ridges, of which the angles both of the head and body are raised into spines. Mouth and snout before the eyes, as in others of this family; both sexes have pectoral fins, the females only have an anal, and there is no caudal fin. After death the head from behind the pectoral becomes permanently bent at an angle with the body; which from its resemblance to the head of a horse, has given occasion to a name of these fishes. The males have a pouch for hatching the young.

HIPPOCAMPUS.

Sea Horse, Short-nosed Hippocampus,	Willoughby; p. 157, Table I 25, f. 4.
Syngnathus hippocampus,	Linnæus.
Hippocampus brevirostris,	Cuvier. Yarrell; British Fishes, vol. ii, p. 452.

This curiously-shaped little fish is common in the Mediterranean, but becomes more rare south of this, and to the north, although it has been obtained at several stations on the south coast of England and in Ireland; and as it scarcely appears capable of a long voyage, we are led to the conclusion that it must have been bred not far from where it has been obtained. We are informed that it has been met with at Yarmouth, in Hampshire; and Mr. Martin, of Weymouth, informs me that he has frequently taken them in a shrimp-trawl along the Sandwich Flats in Kent. I have heard of one that was taken in the Tamar; and in Ireland, on the authority of Mr. Thompson, it has been taken in Dublin Bay, at Belfast, the county of Antrim, at Youghal and Smerwick Harbour, on the coast of Kerry. Mr. Lukis has given an interesting account of the habits of a couple which he obtained in Guernsey, and kept alive for a considerable time.

Like some of the Pipefishes, they seek for some floating object round which to entwine the hindmost portion of their body by way of support, while the upper part remains free, and the head bent, with the lively eyes directed everywhere, singly or together, in search of food, towards which they steer their support by joint action of the dorsal and pectoral fins. It was observed also that the under part of the cheeks was used when it was desired to obtain a new support, so that the tail might entwine itself afresh. Mr. Thompson remarks that two very small examples were taken from the stomach of a small Cod.

Contrary to our usual custom, and for want of a fresh specimen, the description and figure we give of this fish are from a dried example from the Mediterranean. The absolute length a little short of six inches; the body compressed, deep, the depth ending at the vent, and from thence tapering to a slender termination. The snout in front of the eyes slender, and with the mouth shaped as in the Pipefishes; teeth in the jaws discernible; eye large; head compressed; gill-covers long, opening of the gills high and small; the head rising posteriorly into a crest, with bony elevations, which are highest above the gill-covers; a narrow depression between the eyes. Seven spinous ridges along the body to the dorsal fin and vent, of which a pair run parallel along the ridge of the back, where the spines are the most prominent, behind the dorsal fin tapering and square. There are twelve circular ridges, each having a spine where it joins the longitudinal ridges; on the square portion of the body thirty-two circular ridges. The pectoral fins are close to the head, and Willoughby compares their appearance to ears; the dorsal fin about the middle of the body; the head bent and the caudal portion curved even when alive. Willoughby says that the proper colour is a dull green, darker on the hindmost part, but after death it becomes dark brown.

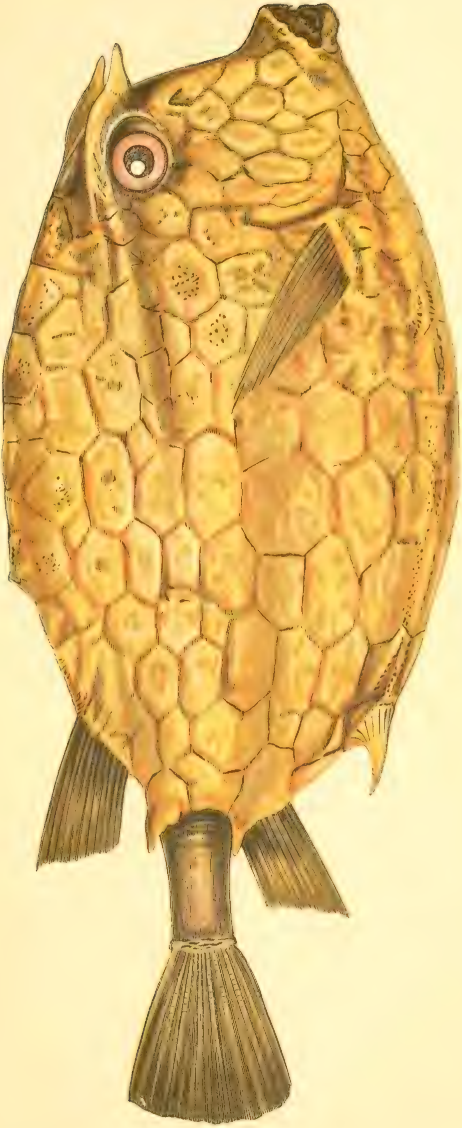
OSTRACION.

The head and body covered with regularly-formed bony plates, fastened together so as to form an inflexible shield, so that the only moveable parts are the tail, fins, mouth, and border of the gill-opening. The mouth has separate teeth. The greater number of their vertebræ are firmly united together.

FOUR-HORNED TRUNKFISH.

Piscis triangularis,	Jonston; Table 45.
" " *cornutus Clusii,*	Willoughby; Pl. I 14.
Ostracion quadricornis,	Linnæus.
" "	Intellectual Observer, No. 30, p. 407.

It was formerly believed that the fishes of this remarkable genus were to be met with only in the far east, or at least nowhere except in very warm climates; and although when voyages along the coasts of Africa and India had become frequent several species became known to the observers of nature, they were for a long time regarded only as strange freaks of nature, which might add a new interest to the cabinets of the curious, but of which the habits and distribution over the globe could be only a little studied. There were indeed a few particulars about them in which naturalists who were not travellers were fortunate, for with only a little care they might be brought to this country without distortion of shape, which was far from being the case generally with numerous fishes of other classes that were imported into England from the same regions—illustrations of which may be seen in the works of our older writers, but especially in the representations o. the fishes of Amboyna in the work of Ruysch, entitled "Theatrum Omnium Animalium;" and there is good reason to believe that the distortions inflicted on some were made



FOUR-HORNED TRUNKFISH.

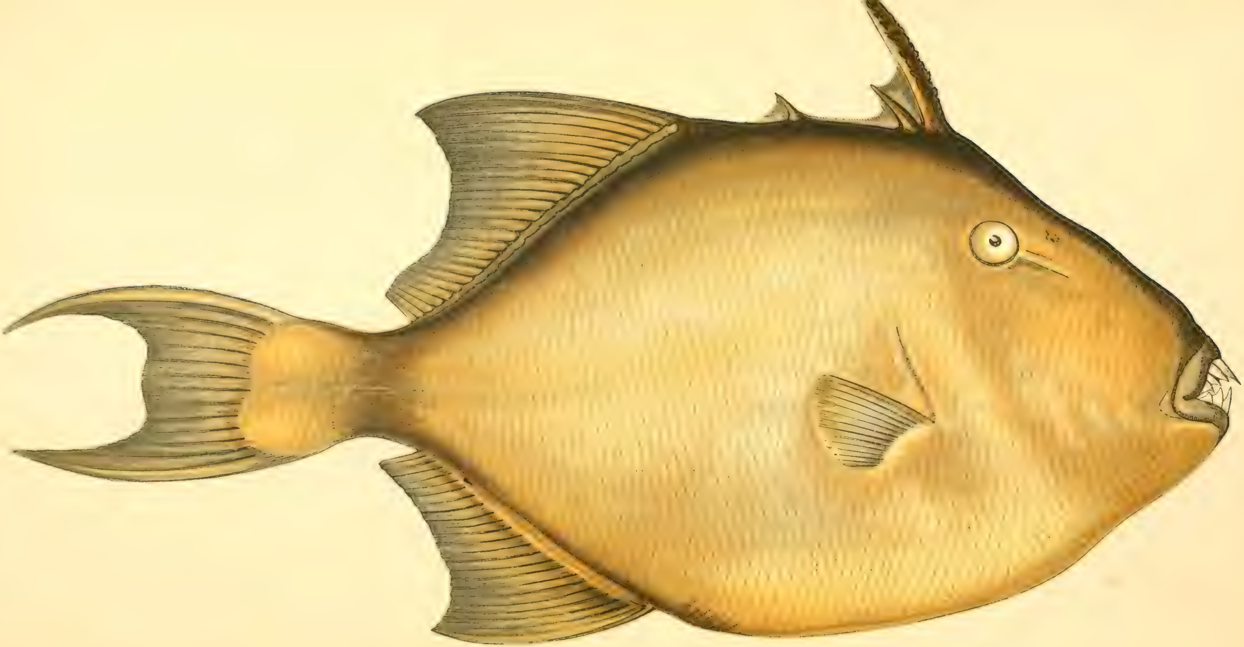
CCXLII

designedly, for the purpose of rendering what was strange and remarkable still more hideous or curious.

It is to one of these fish, as referred to above, to which I would call the attention of British naturalists as laying claim to be regarded as a lately-discovered, and of course rare visitor to our shores, the evidence of which we shall produce; but that any of this genus should be met with, even in the warmer seas of Europe, was not thought of until the researches of Risso led it to be understood that a few examples which belonged to two species of this family had come within his notice in the neighbourhood of Nice. These were *Ostracion cubicus* and *O. trigonus* of Linnæus; and this writer assures us of the certainty of what he relates concerning them, although he appears to have been prepared for the incredulity with which his statement would be received by many naturalists. A third species seems to be hinted at by Dr. Gulia, in his "Tentamen Ichthyologiæ Melitensis," (p. 40 of the Discourse sulla Ittiologia,) but as no description is given, and it had not come under his own inspection, we are not at liberty to refer it to the species presently to be described.

But the question is of no small interest as regards the authority on which we claim for our own the example of which we give a figure taken from the specimen; and to this the reply is short and precise. The first intimation of the alleged fact of the capture on our coast of an example of the Four-horned Trunkfish was received from Robert Lakes, Esq., of St. Austle, himself well known as a naturalist, chiefly in the department of ornithology; and, as regards veracity, he is beyond a doubt. Such a curious fact as the taking this fish on the coast of Cornwall could not fail to lead to further inquiry, in reply to which the fish itself was sent, with the assurance that it had been obtained from a fisherman of Mervagissey, on the south coast of Cornwall, and that this man affirmed he had taken it in a net at some rather considerable distance from land; and it was added that this fisherman was considered to be of sufficient credit to warrant the belief that the information he gave might be relied on. It appears certain that this individual could not have been influenced by any motive of gain in the information he gave about this fish, for the remuneration given him was slight, if, indeed, he received any reward whatever. It was elicited also on further inquiry that a fish exactly similar had been taken about two years before this by a fisherman of the same place; and another was viewed at leisure, and particularly described to myself, but not taken, by an ordinary observer, who watched it in shallow water further east on the same coast.

The length of the specimen is ten inches, of which the crust measures seven inches and seven eighths; the height where deepest three inches and three eighths. The head slopes suddenly from the eyes. The general form compressed, sharply ridged along the back, flat and wide at the belly; the section of the shape therefore triangular. Eyes in front elevated, and above each a prominent ridge, from which projects forward in a slight curve a stout spine; the pair resembling horns. The snout projects a little; mouth small, lips covering a row of conical teeth; the upper row, as far as they can be counted, eight, below six. Gill openings a perpendicular slit. The back rises in a ridge from between the eyes, and slopes down again towards the dorsal fin; and about an inch and a half before this fin is a small elevation; the fin itself narrow at the root, but extended in breadth. Anal fin further back, nearer the tail than the dorsal. A prominent spine posteriorly on each margin of the flattened surface, from which the thin border rises to the place where the moveable caudal portion protrudes from the crust in a straight rudder, ending in a caudal fin; the border of which in this example is injured. The head and body are covered with hexagonal plates, marked in lines round a raised centre. The pectoral fin narrow. Colour yellowish brown, but obviously faded. In another example the border of the dorsal, anal, and caudal fins is round; the general colour dark, with a tinge of blue; but this was not a British specimen.



FILEFISH

CCXLIII

BALISTES.

The body compressed, the skin both of the head and body covered with regularly formed plates, which do not overlap each other like scales; the mouth small, with distinct, strong, and broad teeth. The gill openings simple, close above the pectoral fins. Two dorsal fins; the first with very strong spines, of which the first is much the longest, and of peculiar setting on, so that they can be depressed only in conjunction with each other.

FILEFISH.

CAPRISCUS. MEDITERRANEAN FILEFISH.

Balistes capriscus,	Linnæus. Willoughby; p. 152, Pl. I 19.
" "	Cuvier.
" "	Yarrell; Br. Fishes, vol. ii, p. 472.
" "	Jenyns; Manual, p. 492.

This fish is an inhabitant of the Mediterranean, where Risso reports it as showing itself chiefly in the hot season of the year; but it appears to be scarcely common even there, since Willoughby was not able to obtain an example, except as preserved in a museum; and he appears to have known nothing of another species of the same family, which is found in the same sea, and with which the one under consideration might be confounded; but which may be easily distinguished by its more lengthened shape, when the two are compared together. It was in the month of August, 1827, that the first British example on record was obtained on the coast of Sussex by J. G. Children, Esq.; and which is now preserved in the British Museum, but how it was taken is not stated.

Another specimen is also said to have been met with in the Bay of Galway, in Ireland, but no further particulars are given;

and therefore it is with the greatest satisfaction that I am able to record the capture of a third example, now in my possession, at Port Loe, on the south coast of Cornwall; where it was entrapped in a crab-pot in the first week of August, of the present year, 1865. There can be no doubt that it had forced an entrance into this fatal prison for the purpose of feeding on the bait prepared to entice the Crabs and Lobsters; and the fortunate possession of this example fresh from the ocean has enabled us not only to produce a more correct resemblance than has hitherto been within our reach, but also in my description to furnish a larger number of particulars than as I believe are elsewhere to be met with.

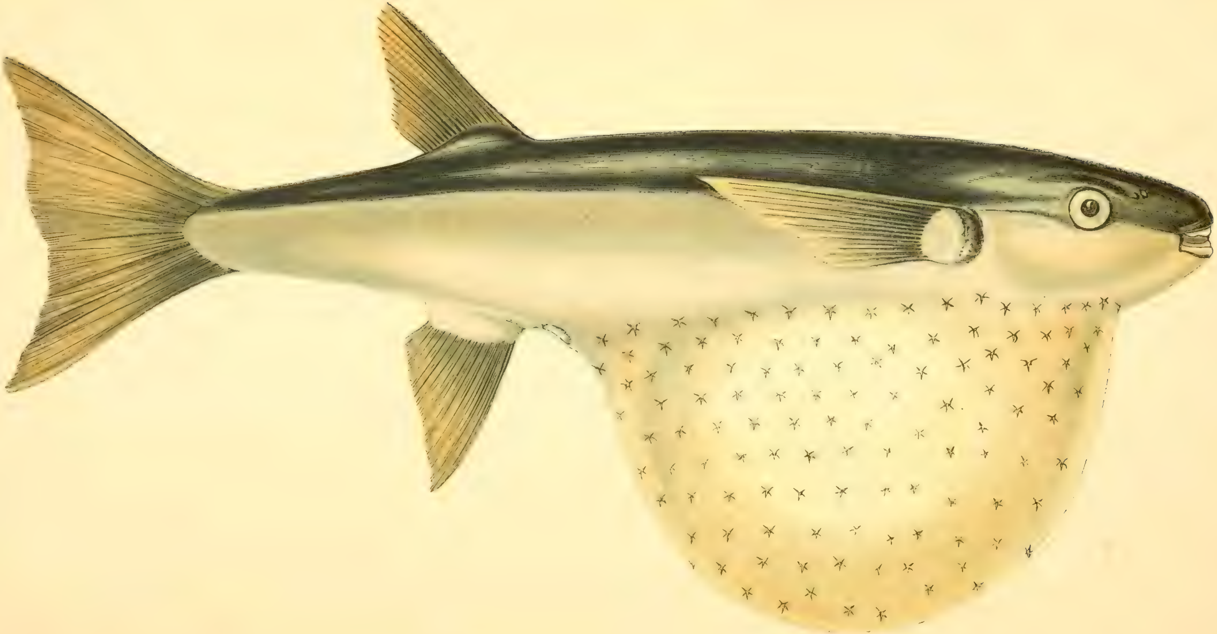
This fish appears to have been well known to the ancient Greeks and Romans, by whom it is represented as being singularly and pertinaceously bold and pugnacious; and as such it is described by Oppian under the name of Mus, or the Mouse:—

> "The Mus's hurtful race, of bulk not large,
> And bold to an extreme, e'en man to charge
> With hostile front. On his firm teeth he trusts,
> And horny skin, to guard from hostile thrusts."

The length of this example to the middle border of the tail was twelve inches, its greatest depth (both in a straight line) six inches and a half, the greatest extent in that direction being at the last ray of the first dorsal fin; the body and head compressed, covered with plates of rather small size, which have the appearance of scales, but do not overlap each other. They are firmly attached to the body, and are scarcely perceptibly rough. A lateral line scarcely perceptible proceeds forward from the tail, but cannot be discerned for more than a third of the length of the body. The head possesses a little breadth before the eyes, and slopes downward from the front of the first dorsal fin, the outline slightly waved; and it even rises a little from the first ray of this fin to the last. Eye of moderate size, high on the side of the head, round with a defined firm border; the pupil small. Nostrils slight, in a small depression not far from the eye; and a small separate channel forward from the anterior border of the eye. The gape limited, the lips not covering the teeth, which project; a pair in front of both jaws longer than the others, those behind becoming gradually shorter; all broad at the root, flattened, with a separate point or projection on their hindmost edge. Besides the pairs in front I could only count three others on each side.

Opening of the gills formed of a linear slit immediately above the root of the pectoral fin; and close behind it, above the root of the pectoral, a stout flat bone with a wing on its lower portion. The first dorsal fin slightly in front of the line of the base of the pectoral, situated in a channel, with three stout rays; the first two inches and a fourth in height, slightly curved, along its front studded with rough points; the next ray much shorter, its root close to the first ray; the third ray short and far behind. The second dorsal three fourths of an inch behind the end of the first; broad at first, third and fourth ray the longest; then narrower, but not reaching the tail; twenty-eight rays; anal fin shaped like the second dorsal, and beginning at about opposite the sixth ray of that fin, ending opposite each other. In front of the anal fin is the vent; and close before it obscure marks of rays as of a fin sunk in the border of the surface; forward from which is a firm structure, as of a sunken shield; but there was no appearance of a projecting spine and raised fin, as represented by Willoughby, nor of a prominence as shewn by Mr. Yarrell. But when an attempt was made to *set up* this example these projections appeared, and not until then. Willoughby also shews the membrane of the first dorsal as joined to the second, which is not the case in the present instance; nor is the chink continued backward beyond the fin itself. A curious flat and narrow border passes along the root of the anal and second dorsal fins. The body becomes wider (or deeper) at the root of the tail, and ends heart-shaped. The tail wide at its upper and lower border, where it is carried out to about twice the length of the middle rays; but those immediately in the middle are more extended than such as are on each side of them; caudal rays thirteen in number, stout; one on each border simple and stoutest of all.

The colour of this example is for the most part a dull pale yellow, dark on the back and top of the head, more dusky towards the tail; pectoral fins with a tinge of yellow; the other fins dark. In its more native element in the Mediterranean the colour is described as with streaks or clouds of blue, yellow, and green, varied by reflections of violet, on a dusky ground; iris golden yellow, the pupil blue; and the surface of the body is said to be so firm and rough as to be capable of polishing wood or ivory; and when examined with a lens, in our example these rhomboid plates appear to be studded over with dots of a marble substance, but with little roughness of texture.



PENNANT'S GLOBEFISH.

CCXLIV

TETRAODON.

The jaws divided in the middle by a suture above and below, so as to present the appearance of forming four prominent teeth. The lower portion of the body covered with spines, and capable of being inflated; orifice of the gills small.

PENNANT'S GLOBEFISH.

Tetraodon stellatus,	Fleming; Br. Animals, p. 174.
" "	Donovan; Pl. 66.
" "	Jenyns; Manual, p. 489.
Tetrodon Pennantii,	Yarrell; Br. Fishes, vol. ii, p. 457.

This fish is seen so seldom, and for the most part within such a limited district, that we may suppose its native haunts to be at some considerable depth of a confined space in the ocean; from which its wanderings have been caused by some unusual influence, which probably may be disease. Yet an exception to this latter remark may apply to an example that was met with in the Solent water, where the tide retires to a large distance, by which means this Globefish, which measured a little more than twenty inches, was left, in the possession of active strength, in a hollow of the wide-extended sands of that shore.

I owe to the kindness of the Earl of Enniskillen the information of an example that measured seventeen inches, which was caught at Charmouth, in Dorsetshire; and from Mr. Thompson and his Editors we learn that three have been taken in Ireland; two of which were in the county of Wexford, and the third on the coast of Waterford. In Cornwall one was taken near Polperro, and several have been obtained in Mount's Bay; of two of which we give the particulars, as they in some degree throw light on the actions of this fish; and especially as regards the structure which by nature had been provided for its defence, but which had in these instances become the means of leading to its destruction. These two examples were taken about the same time and nearly at the same place, near Penzance; one of them on the 27th. of August, and the other on the 17th. of September; and it is remarkable that a specimen caught at St. Ives was obtained on the 29th. of September of the same year.

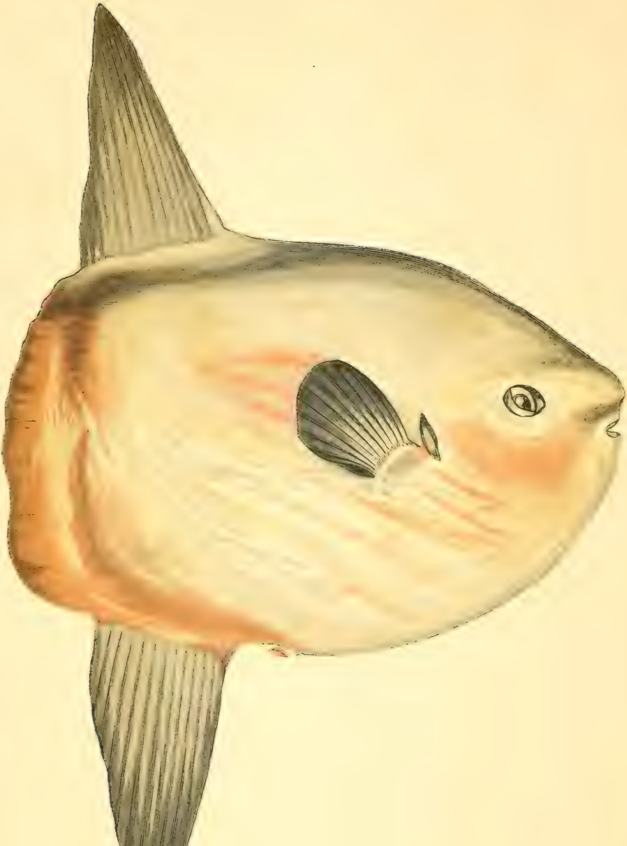
The first of these was observed by some schoolboys near the rocks, as it floated with its distended globe uppermost. It was incapable of making its escape, and was secured by placing a basket under it; and it was immediately conveyed to Mr. R. Q. Couch, by whom a figure of it was taken, and which is now the original of our representation, together with a description; both of which are beyond question more characteristic than such as have been derived from specimens that have suffered distortion from the manner in which they have been preserved.

Our second example was first seen by a boy floating with its distended globe uppermost; but although within his reach he was not able to secure it; and when afterwards it was discovered by boys the inflation had disappeared. On their meddling with it it assumed the natural position, but in its efforts to escape it only made a circuit in the water. For a time it gradually passed seaward in an apparently exhausted condition; but in passing near a projecting portion of the rocks it was taken on shore, and immediately conveyed to my son above named; to whom it afforded an opportunity of examining the inward structure of some of its parts, of which we shall give an account.

The length of the example described was twenty-two inches and a half, the body, independent of the globe, slender but round and plump; round the distended part two feet eleven inches; from the front to the tail along the back nearly straight. The mouth small, teeth projecting not much unlike the beak of a parrot; when the mouth is closed the upper pair overhang the lower; below the mouth a gradual slope, which suddenly distends into the globe, that reaches to the vent, which is large. The skin is soft, like velvet, and elastic; capable of considerable motion over the muscles beneath it; the globe covered with distant star-shaped depressions, each of which bears a prominent spine with four horizontal branching roots or supports, arranged in lines running obliquely backward. Eye eight tenths of an inch in diameter, and two inches and two tenths of an inch from the front. No visible gill-covers; the pectoral fin, with fifteen rays, is two inches and a fifth behind the eye, placed in a depression of the skin; the anterior portion of which has a free margin, opening into the orifice of the gills; the posterior continuous with the skin of the sides. No lateral line. Rays of the dorsal fin eighteen, the anal fifteen; these fins opposite each other, with fleshy roots, the anal near the vent, prominent; the tail expanded, waved. In this example the upper parts were dark with a tinge of blue, below, with the globe, silvery white.

But in the second example, which was smaller, the back was a lively blue; of which colour also the other examples are described. The skin is tough, and could be removed easily; the cellular tissue loose; nerves of the skin large; two large and long muscles extend from the pelvis along the lower border of the globe; and so before, passing backward, with lateral fibres passing transversely; all of them intermixed. Anteriorly two long bones from the sternum passed obliquely backward, one on either side, the whole length of the abdomen, and from these the powerful circular fibres arose to assist in contracting the globe when necessary. On the back the skin is as if tattooed; an arch over each eye, and behind this a transverse arch; from which there is one along the back to near the caudal fin; which fin has twelve rays. The air-bladder is large, and separate from the globe.

Professor Owen says that in the Globefishes the great air sac seems to be a more direct development as a culde sac (or pouch) of the gullet; and these fishes blow themselves up by swallowing air, which escapes through a large anterior oblique orifice into the sac; and this again communicates with the fore part of the gullet by a second opening much smaller than the first, and having a tumid valvular border; but it is hard to imagine how this air for distention can be obtained at a considerable depth from the surface; and in the instances which are known it has not been discharged when safety required it in order to escape capture. The supposition is ventured, however, that when deeply immersed it is water that is swallowed for distention, and not air; in proof of which instances have been mentioned to me by sailors, where distended fishes have fallen under their observation, which, on being cut open, have discharged a large quantity; as was the case also where a Porcupine fish (*Diodon echinatus* of Linnæus) was disabled by the *grains* thrown at it at the entrance of the British Channel. On receiving the blow it became greatly distended, and when taken on board the ship, and pierced with a knife, a considerable quantity of water flowed from it. This fish was brought to me on being landed; but it can scarcely be deemed a British example, from the distance from our shores at which it was taken.



[illegible]

[illegible]

ORTHAGORISCUS.

The body compressed, firm, without spines; the tail high as the body, and confounded with it, being in connection with the separate dorsal and anal fins. The jaws undivided on their edge, covered with uniform enamel in place of teeth.

SUNFISH.

Sunfish,	Willoughby; p. 151.
Tetraodon mola,	Linnæus.
Cephalus brevis,	Cuvier.
Orthagoriscus mola,	Fleming; Br. Animals, p. 175.
" "	Jenyns; Manual, p. 490.
" "	Yarrell; Br. Fishes, vol. ii, p. 462.
" "	Bloch; Pl. 128, the young fish.
" "	Yarrell; Br. Fishes, p. 464, the young fish.

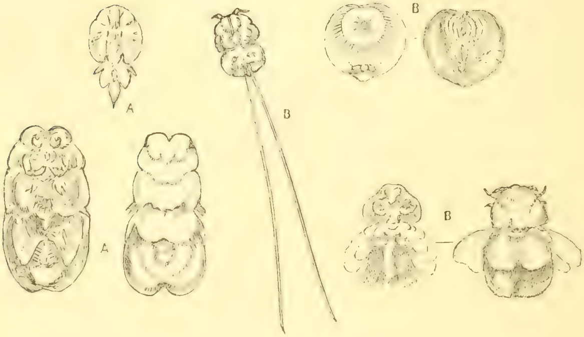
All the figures referred to are the less characteristic as having been from dried examples.

This strange-looking fish is usually spoken of as rare, but it can scarcely be considered so on our south and west coast, where it is not common for a year to pass without the reported capture of a few. This is usually the case in the warmer months, although in some instances an example has loitered until late in the autumn. Single stragglers have also been met with beyond what may be considered their ordinary range. Mr. Peach informs me that he has known it taken at Wick, and I have been assured of its occurrence as far north as the Orkney Islands. Dr. McCoy says that it is not uncommon in Australia, where a large quantity of oil is extracted from it. We shall mention an instance of the taking of a Sunfish with a baited hook; but the more usual capture has been when the fish has been discovered as it floated at the surface, and sometimes in the condition of apparent sleep, with the head, even below the eyes, above the water, or lying inertly on its side. It is then approached by the fishermen without alarming it; but if roused it will put forth strenuous efforts to escape. In one instance, when laid hold of with a gaff, it exerted itself so powerfully as but for an accidental hindrance to have drawn a strong man overboard, and the hooked instrument was carried off as the fish dived into the depth. The escape, however, is usually along the surface, and often with swiftness, so that in a case of which I was informed, a rowing-boat was not able to overtake it. But it is not always, and perhaps not often that they are so fortunate as to escape; and when laid hold of it has been often observed that they have uttered sounds which in some instances have been described as like strong and anxious breathing, while other fishermen have compared them to the loud grunting of a hog, a circumstance which is also mentioned by Lacepede. When the eye is touched, and it has been said, when it is only threatened, the ball is drawn backward into the socket, while the mass of cellular membrane that lies at the bottom rises up and covers it. This withdrawal of the eyeball has also been noticed by Lacepede, and is effected by a special organization of muscles fitted to the purpose. A fisherman gave me information of one which he had taken and kept in his own boat for half an hour, after which he threw it again into the sea, and then, to his surprise, it darted away, as he said, with the swiftness of an arrow.

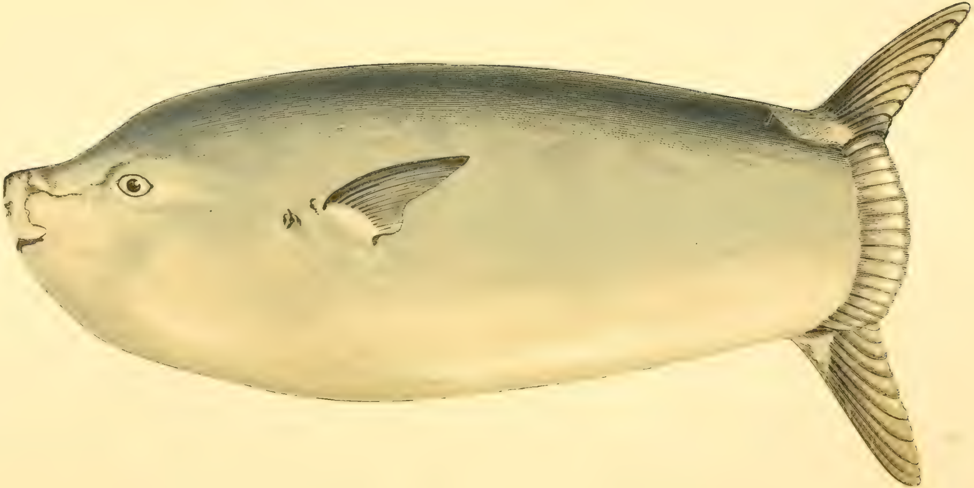
The food of the Sunfish appears to be diversified. I have learned from William Thompson, Esq., of Weymouth, that a young example, eighteen inches long, was caught with a line in whiffing off the coast of Jersey. On one occasion seaweed was found in the stomach, in another fragments of coralline; and Dr. Carus remarks of one he saw in the Scilly Islands, that it had a barnacle in its mouth; but commonly, however, we find only mucus in the stomach. In England no use has been made of this fish, except that from its singular shape it is sometimes exhibited for show. As food it is not thought of; but a gentleman accustomed to the sea informed me that in the Mediterranean he procured a portion of a large one to be cooked for his table, and he thought it good, in taste much like the common crab.

The Sunfish reaches to a large size, and the largest I have notice of, which was caught off Berry Head, measured seven feet nine inches in length with eight feet and a half in depth, including the fins, and it is probably the same that is now in the British Museum. But a more usual size scarcely exceeds the half of this, the general appearance conveying the impression of its being the anterior portion of some large fish that has been separated from the rest of the body, to which opinion the structure of the tail contributes not a little. The example described measured three feet in length, which includes the tail; the depth of the body about two feet, but taking in the perpendicular fins, four feet. The head bony, and thicker than the body, with a prominent ridge above the eye; the mouth under a short and blunt snout, small, capable of little action; no appearance of a tongue; each jaw merely an enameled surface of bone, but in the lower jaw, when cleaned from the flesh in the instance of a large individual, the surface of the concave portion had several projections which resembled teeth. The body about six inches thick; opening of the gills small, a little before the pectoral fin; eye lateral, of moderate size, moveable in its socket, furnished with a nictitant membrane. On the body several lines which seem fitted to facilitate the bending of its surface in active motion. The vent prominent, close before the anal fin; the pectoral small, round, received into a depression of the surface; the dorsal and anal triangular, at their base joined to the caudal; which latter is narrow, often waved, running the breadth or depth of the body, and in the recent state not easily distinguished from it. Colour of the back and fins dusky, sometimes nearly black, sides and belly shining white. The name of Sunfish will not appear ill bestowed when it is seen brilliantly shining on the surface of the sea with its side uppermost; an action supposed to be an indication of continued fine weather. In some smaller examples I have seen beautiful variegations of colour in stripes and blotches of yellow, blue, and white; and on one occasion an example was brought to me alive, with an appearance of distension or fulness, the nature of which appeared as the fish died in a large discharge of fluid of an offensive smell, from an outlet between the vent and anal fin; and on dissection this was found to lead to a large urinary bladder, which communicated with large kidneys by a couple of ureters. The stomach long and capacious, the intestine thick and convoluted into a ball.

The Sunfish is exposed to the annoyance of several species of parasitic animals, three species of which are commonly found adhering to the skin; and there is one, often an inch in length, which never fails to be found grasping with its sharp claws the fibres of the gills, no doubt to the great annoyance of its host.



A—Parasitic on the gills of the Sunfish.
B—Parasitic on the skin of the Sunfish.



LONGER SUNFISH.

CCXLVI

LONGER SUNFISH.

Orthagoriscus oblongus,	Bloch, Schneider.
" "	Yarrell; Br. Fishes, vol. ii, p. 469.
" *truncatus,*	Fleming; Br. Animals, p. 175.
" "	Donovan; Pl. 41.
Cephalus oblongus,	Cuvier.

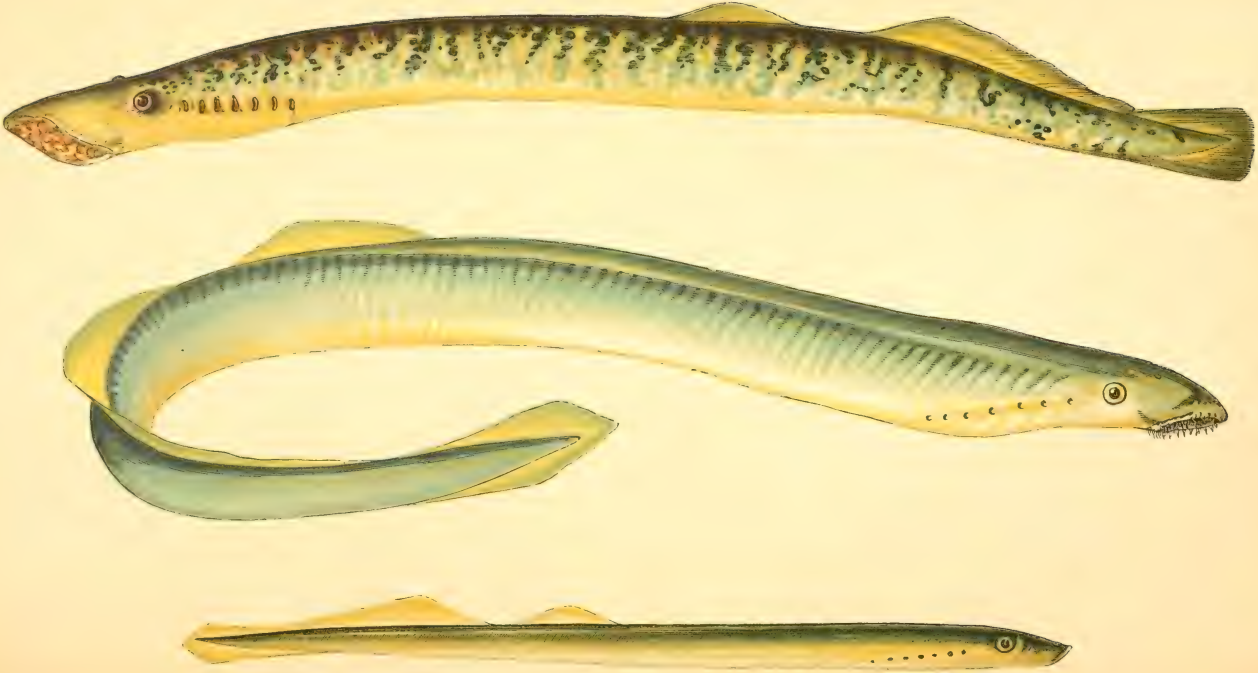
Although the Longer Sunfish is perhaps as widely distributed as the Shorter fish, for it is found at the Cape of Good Hope, it is far from being equally common; as will appear from the brevity of our enumeration of the places where it has been met with. It was first made known as a British fish by Dr. Borlase, who has given a representation of one which was taken in Mount's Bay; where two others were obtained in the year 1855. One of large size is recorded as having been taken at Plymouth. Donovan's specimen was caught in the Bristol Channel; and Mr. Dillwyn mentions it as washed on shore at Swansea. Two or three have been procured in Ireland, and from the evidence of Dr. Deguid there is reason to suppose it has occurred in Orkney. An example had wandered into the newly-made lock of the canal at Charlston, in Cornwall, and it was secured for the museum of the Royal Institution of Cornwall at Truro. It is from this our figure and decription have been derived; but of the habits of the species little seems to be known except that it does not shew itself basking on the surface like the wider fish, and that crustacean animals have been found in its stomach.

The length of this example was twenty-two inches, and the depth about two and a half of the length, but including the upright fins eleven inches and a half. Dimensions of the mouth small, with the appearance of a band or lip over it. From the snout to the eye two inches and three fourths, to the root of the pectoral fin eight inches and a half, the fin not round, but pointed, the rays fifteen; caudal fin broad (or long,) not quite the whole depth of the body, an inch and a half, with eighteen rays; the anal and dorsal fins measure six inches, the former with eighteen rays, the latter seventeen. The colour had faded, but appears to have been dark, with a blue tinge above; white on the sides and below.

In the figure of Schneider, Pl. 97, and Cuvier's definition, the skin is represented as hard, and divided into small six-angled compartments, of which Donovan's figure shews also some faint marks; but I did not discern them in the present instance. This species cannot be confounded with the kindred Short Sunfish, from which it differs not only in its relative dimensions, but in the position of the eye, which is higher in the head, in the shape of the pectoral fin, and also in the tail, which falls short of the depth of the body. But it is said to attain an equal size with that fish.

LAMPREYS.

The family of the Lampreys is so far an aberrant order of fishes, that in their structure and some of their habits they make an approach to the annelid class of animals, or worms; so that they appear to occupy that intermediate ground by which those seemingly distant families of animals are brought into connection with each other, and thereby testify to a governing law in the all-creating mind, through which a high contriving wisdom has been pleased to unite all the classes of animated nature into one consistent whole. These, like other fishes, possess a brain and spinal marrow, and the bones of the spine run in a connected chain to the end of the body; but even in these particulars, in spite of the similarity, there is still a difference from the generality of fishes, as well in structure as in extent of development. Their mouths also are closed in a different manner, so as even to appear longitudinal, and their jaws are so unlike that it is only by analogy we can assign the same name to the bones. All the bones are remarkably deficient in their calcareous ingredients. The bones of the skull are loosely joined together, and in general overlap each other; and through the bodies of those forming the vertebral column, so soft is the substance inclosed within the rings, that an instrument may be made to pass through their length without meeting with an hindrance. Variations in the arrangement of the teeth are characteristic of the species; but if the particular habits of these fish were not known, their situation would appear the furthest removed from the possibility of being brought into practical use. This will be explained when we speak of the individual species; and we only remark in this place that both in their structure and position we judge them to be the representatives of the pharyngeal beds of other fishes, rather than to have an analogy with such as are set in the jaws of other families. A further declension from the type of fishes, with a still more decided approach to the annelid form, will be discerned in those groups that will follow the Lampreys, and which will close our history of the fishes that have been hitherto found in the British Islands, with the exception of a short supplement of such as have been discovered later than the publication of the regular order to which they belong.



SEA LAMPREY

PLANER LAMPREY

PETROMYZON.

The body lengthened, smooth; head rounded, and continuous with the body; mouth circular, closing longitudinally, armed with tooth-like processes in rows. An opening on the top of the head; seven separate openings of the gills arranged along each side. No pectoral or ventral fins; dorsal, anal, and caudal fins without rays.

SEA LAMPREY.

Lampetra, Lampreda,	Jonston; p. 117, Pl. 24, f. 5.
" "	Willoughby; p. 105, Pl. G 2.
Petromyzon marinus,	Linnæus. Bloch; Pl. 77. Cuvier.
" "	Donovan; Pl. 81. Jenyns; Manual, p. 520.
" "	Fleming; Br. Animals, p. 163.
" "	Yarrell; Br. Fishes, vol. ii, p. 598.
" *lamproie,*	Lacepede.

This fish could not fail to be known to the Greeks and Romans, for it is common and of large size and excellency in the Tiber; but much obscurity has hung over it in consequence of the variety of names which were applied to it, and the confusion that followed the application of these names to other kinds of fish in consequence of some perhaps distant similarity of form or habit: a likeness in the last-named particular, even when it was built only on fancy, or still more when on mistaken principles, being a sufficient inducement to class them together, or to confound them one with another. And this we find to be the case to a large extent even in our own day. It was commonly believed in ancient times that there was a fish, called Naucrates, Remora, or Echeneis, which was accustomed to lay hold of a ship, and by means of a magical power or occult quality which it possessed, was able to arrest its progress in the midst of its most rapid course, and fix it stationary even in the middle of the ocean. We have already given an account of some of the supposed actions of the now-recognised Remora, which is a very different fish from that of which we now speak; but ordinary observation had shewn that the Lamprey also was in the habit of laying hold of a ship so firmly as not to be easily separated from it; and, without attending to the difference in the mode of acting, or considering that different fishes might possess the same power, the ancients advanced to the conclusion that where the effect was the same the fishes themselves could not be different. Nor does it appear that this mistake has been altogether corrected, nor the superstition or hallucination been obliterated, at a very modern date; for in Dodsley's "Annual Register" for 1778, is an account of the Paklara, which may be either the Remora or Lamprey, from an abstract of the Travels of the Abbè Fortis, who, after referring to the ancient stories of Anthony and Caligula, informs the reader of what happened within his own knowledge. He says that when he was at sea the steersman ordered the sailors to come abaft and kill a fish which he called Paklara; and in reply to the Abbè's inquiry why he did so, he was informed that it was the habit of this fish to lay hold of the rudder with its teeth, and by so doing it retarded the progress of the ship so sensibly that the steersman was aware of it in a moment, even without seeing the fish itself. This man spoke of the Paklara as a common fish, which in shape resembled a Conger, but in length did not exceed a foot and a half.

The fact, however, of the knowledge of the Lamprey by the ancients, notwithstanding the uncertainty arising from confounding it with others, appears without doubt from the description which Oppian gives, although under the name of Echeneis he confounds the Remora with the Lamprey, to which latter only his particulars can be applied.

"Slender his shape, his length a cubit ends;
No beauteous spot the gloomy race commends;
An Eel-like clinging kind of dusky looks;
His jaws display tenacious rows of hooks;
But in strange power the puny fish excels,
Beyond the boasted art of magic spells."

When, however, the Lamprey had come under the notice of another class of observers in its yearly migration into fresh water, its supposed marine practises were unknown or forgotten, and it assumed names according to the likeness it was believed to bear to some more familiarly-known fishes. Ray, in his little work, "Nomenclator Classicus," very properly finds fault with those English writers, especially the poets, who have translated the Latin name of the fish Muræna by the English term Lamprey, which John Jones, the translater of Oppian, always does, as do others since his day, although these fishes are different in every respect. Yet Rondeletius is sufficient authority for saying that the Sea Lamprey was sometimes called Muræna simply, or *Muræna fluviatilis*—the River Muræna; but he distinguishes it by an anatomical difference in the head from the Muræna of the sea, of which we have already given an account; and, skilful as he was as a naturalist, he thinks the comparison of one with the other not amiss. There is some probability also in the opinion that the Lamprey is mentioned by Ausonius under the name of Mustella in the following verses.

"All through the ponds of Ister's double name,
Frothing the surface the Mustella came;
Watched by observant eyes it holds its way,
And safely shelters in our favoured bay;
Bringing new riches to the wide Moselle;
And its bright beauties who can paint or tell?
On breadth of heavenly blue are dots of black,
Each circled yellow through the luscious track
Along the slippery surface of its back.
From head to vent it suits the nicest taste,
But all behind is dry, and thrown to waste."

Cuvier is of opinion that the Mustella of Ausonius, here described, is the Burbolt; but it appears a sufficient objection to this, that the Burbolt never migrates to the salt water, as the Mustella is represented to do; and yet that the name has also been applied to the last-named fish is not only rendered probable by the fact that it is still called Motella in some parts of France, but it is countenanced even by Pliny, if we admit an amendment of the ordinary text of this writer. He says that the fish which is next in esteem (to the Scarus) for the table is the Mustella; but in contradiction to Ausonius, only for its liver; and further that those of the lake of Brigantia in the middle of the Alps are rivals to those of the sea. But the Burbolt cannot live in the sea. It has been suggested, therefore, that instead of Marinis, (living in the sea,) we should read Muræenis rivals to the Muræenæ; in which case the comparison will have become appropriate, and the identity of Pliny's fish with the Burbolt is rendered more probable.

This sort of Lamprey is often taken in the sea at a considerable distance from land, but the largest number obtained in salt water are of a size far below what they are accustomed to reach. And the peculiar circumstances under which they are thus caught have a reference to some of their remarkable instinctive habits, and especially offer an explanation of the use of the curious formation of the mouth, and of the organization which is fitted to the singular manner in which the function of breathing is carried on. The structure of the mouth we shall by and by describe; but for the present we observe that when the mouth is open it forms an expanded disk, round the deeper portion of which there is a characteristic arrangement of rasping teeth, which teeth the fish has the power of bringing into contact with any surface on which it chooses to lay hold. By an exhausting action, through which the air and water are removed, a vacuum is produced, and thus the fish becomes fixed without any further action of muscular effort. The bottom of a ship or boat is frequently the object to which it attaches itself; and a fisherman has informed me that he has seen it advance and overtake a boat that was sailing at good speed, in order to fix itself on the rudder.

It becomes then a question what is the intention it has in thus affixing itself to an inanimate substance, which it does so firmly that all the strength a man can exert is often unequal to the task of removing it. The intention may be no more than to relieve itself from further exertion in swimming, but it also may be with the hope of feeding on the flesh of an animal for which it has mistaken the ship, according to what we know of its propensity under other circumstances, of which we shall produce some individual instances; but it is affirmed by Rondeletius that it is also with the intention of feeding on the pitch with which the ship has been *payed* or coated, and for which it has been supposed to feel an appetite. Such at least was the opinion formerly entertained by the fishermen of Marseilles, and, strange as it may appear, a similar opinion has been expressed in England by a witness in an inquiry before a Parliamentary Commission on the Salmon Fisheries in the year 1861. It was then shewn that under particular circumstances Salmon as well as Lampreys tasted strongly of tar. The witness said, "We asked the fishermen about it, and they told us that there was a little ripple of tar coming down into the Severn, and that must have been the reason (with the Salmon.) We were rather angry with the fishermen, and then thought they had put these Salmon into a boat where tar had been emptied; but they said no, the tar in the river must have been the reason. We had two Lampreys returned that tasted very badly of tar: we found out the reason of that. Lampreys have mouths like suckers, and live by suction; and they will suck tightly to anything. The boats had been newly tarred, and these Lampreys sucked on to the boat, and from that they were all tar. I am quite certain that the Lampreys did not get the tar out of the water, but out of the boat. These tarred fish were confined to one year." It is not so certain that the vegetable tar attracts these fish as that coal tar drives them away; and, accordingly, it has been noticed that since the time when the sea-going boats have used the latter no Lampreys have laid hold upon them.

But there is another use to which the mouth is applied, and concerning which no doubt can exist, but by which the use of the singular armature and situation of the teeth is to be explained. The whole of the interior arch of the mouth is studded with regular rows of teeth, each one of which on a broad base is furnished with one or two apparently reversed points; and the teeth which are the most distant and concealed are larger than the others, and more effectually crowded with these points. For simply biting, as in other fishes, they are useless; but when the breadth of the open mouth is brought into contact with the surface of a fish on which the Lamprey has laid hold, by producing a vacuum, these roughly-pointed teeth are brought forward in a manner to be able to act on it by a circular motion, and a limited space on the skin of the captive prey is thus rasped into a pulp and swallowed, so that a hole is made which may perhaps penetrate to the bones, and from the torture of which the utmost energy of exertion by the victim cannot deliver it. The most active fishes appear most liable to this infliction, and on none have I found it more frequent than on the Mackarel, although the Gurnard, Coalfish (Rauning Pollack,) Cod, and Haddock are also the subjects of the attack. It is deserving of notice, however, that in the numerous instances in which Lampreys have been found adhering to their victims, and eating into their substance, the depredators have been of small size, even of six inches in length, with a different appearance as regards colour in comparison with the full-grown fish; which latter has only a few times been taken at sea fixed to a boat within our knowledge. It might be supposed that death would be the inevitable fate of fishes which had suffered from the teeth of these devouring Lampreys; but I have examined some that have borne the mark of having been thus fed on, but which have survived to have the wound healed, although not without its leaving an enduring mark.

It is in the spring, and with us about April and May, that the Lamprey is ready to deposit its spawn; and for this purpose it seeks the fresh water of the deepest of our rivers. From the sea it has been brought with the roe enlarged on the 11th. of April, and also in the middle of May; but in Holland, Ruysch says it is so early as February, and Duhamel says they are caught in nets of very fine twine in the River Loire, that runs by Nantes, in January; the fishery continuing until May; while Sir William Jardine assigns it to June for Scotland, and thenceforward so late as to the end of August. It is at this its first entry into the rivers that the fishery is entered upon; and among English rivers the Severn has long been celebrated for it, and for the excellence of the Lampreys taken in it. Indeed it is not known that this fish is much sought after in any other of our rivers; and even there so fluctuating is the taste of epicurism, that within a few years the sale of it has much declined. They are fished for mostly in the night, and from thirty to forty are regarded as a successful adventure, at the price of a shilling to eighteen pence for each fish. Duhamel says that in France, with the nets employed, it is not by the mesh, but by being enrolled in the net that these fish are caught; and those which are taken in this manner are thought to be in better condition than such as are entrapped in baskets of wickerwork, which are also employed; because in the latter they bruise themselves in their struggles to get free.

In remote times of our history this fish was held as of great value, and there are instances in proof that it was once deemed a favourite dish at the table of kings. The death of Henry the First was caused by his having indulged too freely in a dish of potted Lampreys; and a single one of these fish was thought a not unfitting present to be sent by King John to the Earl of Chester; who acknowledged the honour by the present in return of a good palfrey. It was an old custom for the corporation of the city of Gloucester to present to the reigning sovereign a pie of Lampreys yearly; but it appears that this custom has ceased to exist; an end probably having been put to it on the occasion of the passing of the Reform Bill. In the last century also a pie of Lampreys was sent by the corporation of the same city to the Prince of Wales.

As this species of Lamprey enters rivers for the purpose of spawning, in the spring, this is the season of its highest perfection; but immediately after the shedding of the roe so great a change takes place, that they are not only weakened and emaciated, but it has been believed that death is commonly the result. But that this last supposition at least is not correct, appears from the fact, that while in May, twelve months perhaps from their birth, they are often found not to exceed six or eight inches in length, and when a little larger at that season are clearly pregnant with enlarged spawn, examples are not uncommon which measure thirty inches in length; and which therefore we may conclude to have experienced the growths of several seasons, and consequently to have passed through more than one or two of those in which their spawn has been deposited.

The method of proceeding by which a procreant bed is prepared for the reception of this treasure, affords an insight into another use to which the sucking faculty of the mouth can be applied. Both sexes unite in preparing the ground at the bottom of the river, by excavating a trench; and as in doing this it shall happen that stones of considerable size may lie in the way, the mouth is employed in the labour of grasping and removing them, so that the grains of roe may be covered only by a lighter sand. A stone of the weight of two pounds has been known to be thus carried to a sufficient distance; and Mr. Thompson reports on the authority of a fisherman that stones of even ten or twelve pounds have been turned over. Soon after spawning the parent fish return to the sea.

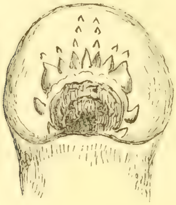
As the manner in which the water is received by this fish for the purpose of breathing, has been described in a way that is contrary to my observations, the following notes are given from my own examination of the subject; derived chiefly from a large example taken in the sea:—When this fish was altogether immersed in the water, the fluid was seen to enter by the orifice on the head, and was discharged through the branchial orifices at the sides. When these orifices on one of the sides were out of the water it was still discharged through both, but with less force; but when the aperture on the head and the branchial orifices on one side were equally out of the water, although the fluid ran out for a short time, as if what had been adhering to the gills within supplied it; yet afterwards it ceased with something of a sucking motion, as if the gills were drawing without being supplied. But on a further trial with the same fish, when the whole body was immersed in the water, a constant current was discharged from, not inhaled by, the aperture on the head, in common with the gills; but when the head was lifted above the water, and all besides immersed, the current ceased from the head, although it continued from the gills. When the mouth was lifted from the water, and the aperture on the head was immersed, no water entered by the latter, although the current ceased from the gills: a circumstance not easily explained, except on the supposition that the powers of life, usually of an enduring kind, were about to cease.

This fish inhabits climates between the very warm and very cold; it is therefore found in the Mediterranean; and also in the north of Europe; where it is mentioned by Nilsson as common in the Baltic and North Seas; but it is not mentioned by Fabricius in Greenland.

The example described was obtained from the Severn, and measured two feet eight inches in length, and six inches and a half round the body where stoutest; which was at the last spiracle; round anteriorly, more compressed towards the tail; rather flat on the head, and when the mouth is closed bluntly pointed in front; but when the mouth is open the appearance is as if the head had been cut off; aperture on the top of the head a little in front of the line of the eyes, and with a raised rim; the eye moderate, lively, proportionally larger in the smaller examples. In a line with the eye are seven branchial openings, lowering gradually in the order in which they are arranged. The first dorsal fin behind the middle of the body, shorter than the second, from which it is widely separated; the second running to the root of the tail, but not joined to it. In this example the tail is square, but in others pointed. The vent opposite the beginning of the second dorsal fin. The colour is varied, mottled with blue and green, but when taken in the sea, much more dull, and often of a uniform bluish tint; whitish below; the eye pink, red, or silvery.

The arrangement and structure of the teeth are characteristic of the species of this family, and therefore requires a distinct description; as do a few other particulars of the structure of this fish, and especially of the organization of its head. When the mouth is expanded it forms a wide oval, of which the border is fleshy and apparently sensitive. In front of the gullet is a curved row of stout teeth, each of which has a stout firm base, with a sharp point; and a little behind them, on the floor, first a pair of elevated rasp-like teeth, having on their upper edge a row of very sharp points. Close behind these a pair of elliptic shape, with their narrow convex bend foremost; and along their edge a row of sharp points. On the upper portion of the mouth or palate, on the fauces two teeth, close together, each with a broad and firm base and short, sharp point. In a line above them upward three similar teeth, each smaller than the next below it; and four rows of similar teeth pass from these in regular succession, in an arched manner, to the border of the mouth; each row containing five or six, except the highest, where there are only one or two of small size. In front of the lower portion of the mouth are three or four regular rows of teeth in a circular course; and thus the whole surface of the mouth and throat is covered with regularly arranged strong teeth, which are not solid, but mere shells that are shed by being thrust off and renewed by others that rise within themselves. The throat teeth are moved by muscles appropriated to themselves, and the seven of the row in front are fixed in a single bone, which is suspended from the skull; to which also the pair above the gullet are affixed. This bone forms a ring; but the rows above, or on the roof, stand, each tooth singly, on a bed of tendinous substance.

Referring to what has been already said of the bones of the head, it should be added that the brain is small and not covered by them; and even the passage from the top of the head through an organized chamber to the gills is behind them; so that more probably they answer to the nasal and lachrymal bones of the higher animals, as appears to be Dr. Grant's opinion in his Lectures. The animal senses of this fish appear to be acute.



Mouth of Sea Lamprey seen from above—to show the crown of teeth, or tooth on the place of a tongue.

LAMPERN.

Lampetra altera minor maculis carens,	Willoughby; Pl. G. 2, f. 1, the word *minor* referring by comparison to the Sea Lamprey.
Petromyzon fluviatilis,	Linnæus. Bloch; Pl. 78, f. 1.
" "	Fleming; Br. Animals, p. 163.
" *pricka,*	Lacepede.
" *fluviatilis,*	Cuvier.
" "	Jenyns; Manual, p. 521.
" "	Yarrell; Br. Fishes, vol. ii, p. 604.

Lacepede says that this fish is an inhabitant of lakes rather than rivers, and that it comes into the latter only when prepared to shed its spawn, which is in the spring. It may be from the general absence of lakes in England that with us it is usually found in rivers, and in preference it abounds in such as are deep and wide; and it is there they may be obtained throughout the year, although there appears to be no doubt that some individuals have been found in the open sea, to which it is probable they do not proceed at all seasons, as if in regular migration, and where they do not continue long.

This species has never been so highly valued for the table as the larger Sea Lamprey, although a small trade has been carried on by pickling it to send even to India; but on some accounts it is of greater importance, and might be of more if it were employed for the same purpose more generally among ourselves, as it is abroad. Dutch fishermen have long ago discovered that it may be made an excellent bait for the Turbot and Cod; and, as their own country cannot provide a sufficient supply they have had recourse especially to the Thames, where the vast abundance in which this fish is (or at least was) found, has enabled the people living along the river to furnish the numbers of which we receive accounts. The Dutch have, or have had, a contract with men of Teddington for the regular supply of these fish, to be used as bait, and they are delivered alive, in which condition they are kept until wanted; and the price has varied from £3 to £5, or even more, the thousand. We learn from the Report of a Parliamentary Commission, that one hundred and twenty thousand were caught by one person in the course of one winter. In a single season one man received £400 for the numbers he sold; and the whole expenditure for a year has amounted to £4000.

To supply such a demand this fish must be highly prolific, and more so than any others of this family with which we are acquainted; as also it must be safe from the depredations of devourers; although there is evidence that they are victims to the omnivorous appetite of rats. We learn, however, from the "Fisherman's Magazine," vol. ii, that however prolific naturally, from some cause, of which the increasing foulness of the Thames is the most probable, the numbers of these fish have fallen off greatly within a few years, with the prospect of the utter extinction of the fishery, to the great loss of course of the fishermen who depended on it for subsistence, as well as to those who have used it as bait.

It is probable that fishermen who have been engaged in supplying the demand for these fish could communicate many particulars of their habits yet unknown to naturalists; but what is generally known is for the most part confined to the incidents which attend the deposition of the spawn and the occurrences accompanying the season of breeding. Mr. Yarrell has remarked in the "Journal of the Proceedings of the Zoological Society," that he had examined individuals of this species every week from March to the middle of May, and that to the 19th. of April more females than males were taken; but after this period, the females being nearly ready to deposit their roe, the males were most numerous in the proportion of two to one. All the females taken about the 26th. of April were in a state to deposit their roe; and the milt of the males, now become fluid, passed in a stream from the sheath behind the anal aperture on making slight pressure on the abdomen.

By the 10th. of May nearly the whole of those examined had deposited their spawn. In addition to this Sir William Jardine remarks, "The manner in which the Common (Sea) Lamprey and the Lamperns form their spawning beds is very curious. They are not furnished with any elongation of jaw, but the want is supplied by the sucker-like mouth, by which they individually remove each stone. Their power is immense. Stones of a very large size are transported, and a large furrow is soon formed. The Sea Lampreys remain in pairs, two on each spawning place, and while there employed retain themselves affixed by their mouths to a large stone." The Lampern, and another small species which he has not determined, but of which I shall give an account, are gregarious, acting in concert, and forming in the same manner a general spawning bed.

Some further particulars are given by an anonymous writer in "Loudon's Magazine of Natural History," vol. v. "On the 8th. of May I saw a number of Lampreys in the act of spawning. After observing them for some time, I observed one twist its tail round another in such a manner, and they both stirred up the sand and small gravel from the bottom in such a way, as convinced me it was a conjunction of the sexes. However there were so many of them together, and they kept so continually moving about, that I could not single out the two individuals, and thus ascertain whether they were male and female; but I felt so desirous of being able to set this question at rest that I went again next morning, and was fortunate enough to find only two, a male and female. I then witnessed several sexual conjunctions, during which the sand and gravel were stirred up with them, and each of which was followed by the ejection of a jet of eggs from the female. I then caught them both, and dissected them. The sexual organ in the male was projected above a quarter of an inch, and the body filled with milt; the female, although she seemed to have already shed a considerable quantity of her spawn had still a tolerable stock remaining. I frequently afterwards witnessed the same thing, and always found the same difference of sexes."

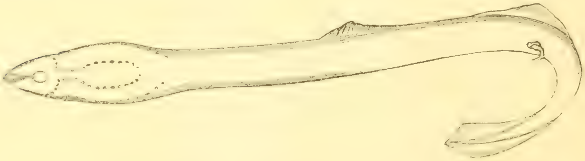
The example described was procured from the Severn, and was the largest of two or three. It measured about a foot in length, but they are sometimes fifteen inches; in general shape much like the young condition of the Sea Lamprey, but the mouth less expanded; the teeth very differently arranged, and not nearly so formidable or numerous; round the disk of the mouth a considerable number of fibres, which appear to be organs of exquisite sensation; but they are more numerous, and of different form and texture from those which constitute a principal character of Planer's Lamprey. At the entrance of the disk, or expanded mouth, below, is a row of small teeth, placed circularly, and at a short distance inward a few rather larger, followed by a pair at the entrance of the throat, which stand higher. Above the orifice of the throat a pair of flattened triangular teeth, separate from each other; and from each proceeds a couple of smaller teeth, with one near the border below each of them; higher up the disk seven teeth in an arched arrangement, forming, with those smaller ones already mentioned, what should be twelve arranged in a half circle, but one of these teeth in this example had been lost or shed. The fins of this species resemble those of the Sea Lamprey, except that in the Lampern there is a low continuance of the second dorsal, which becomes joined to that which as a tail passes round the end of the body. But the aspect of these two fishes is different; which in part arises from the greater protrusion of the head of the Sea Lamprey, and the more arched lowering of its line of direction towards the mouth. The orifice on the head appears as if inclining to the side. Willoughby makes the uniformity of colour, free of mottling, to be a characteristic of the Lampern; which, as regards the older individuals of the other species, will hold good, but it is not so in the younger examples of that fish. In this species the back is a uniform blue, with rings like ribs partially encircling the body; below white; the fins inclined to yellow.

As I am aware that the teeth of this fish are liable to be shed, and perhaps without leaving a mark of where they have been until again restored, I here give the description of them as reported by Lacepede. It is possible also that they may be liable to some variation. He says "At the entrance (of the mouth or disk) a single row of very small teeth, which are placed round its circumference; and within this, in front, there is another row of six teeth, equally small; within this again on each side are three more, which are cut into segments; and still nearer the entrance of the mouth is a thick and crescent-shaped tooth; still further behind a lengthened bone which is placed sideways, with seven small points; a semicircular one still further in, and lastly at a still greater depth within a single tooth or (as he terms it) cartilage. The manner in which they are used appears to be uncertain."

SILVER LAMPREY.

Petromyzon argenteus, Bloch; Pl. 78, 3, which Cuvier pronounces the figure of a young example of his *P. fluviatilis;* which also he does not distinguish from the Lampern. I believe them to be different species, and that Bloch represents the Silver Lamprey, which is a fish not generally recognised by naturalists; although Sir William Jardine appears to refer to it when he describes what he had observed of the actions of the Lampern, as already quoted, and of another which he considered to be distinct from it.

The Silver Lamprey is always of less size than the ordinary dimensions of the Lampern, and proportionally more slender; the form of the head different, in a more decided approach to a lip when viewed from above; the aperture on the head a little in front of a line between the eyes; dorsal fins only a little removed from each other, and the second joined by an evident continuation to the tail; the line of the branchial openings less depressed than in the Lampern in proceeding backward; being in a direct course with the line of the body.



A line of pores on each side along a portion of the under surface, as represented in this figure. In this latter example there appears a process which perhaps appears only at the time of shedding the spawn, and may be confined to one sex only. Something similar to it is seen in what Bloch, as above referred to, calls his Planer's Lamprey.

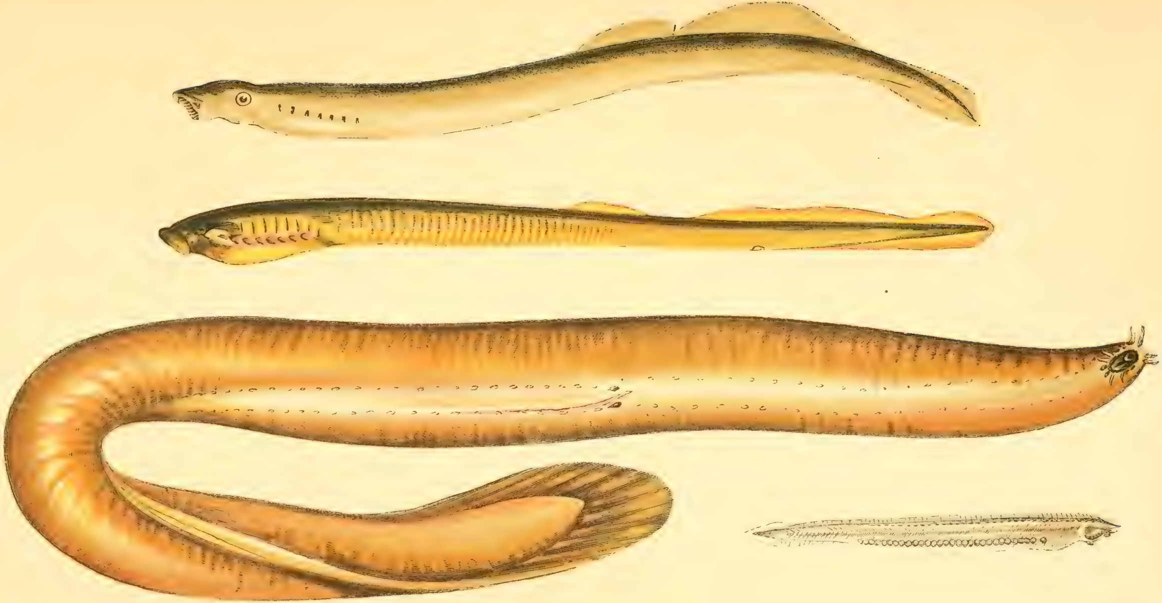
An account of the manner in which these fish proceed while shedding their spawn in one of our smaller streams, was communicated to me by a fisherman who was in search of Lampreys to be employed as bait; for which however this sort is less valued than the Mud Lamprey, as not continuing so long alive on the hook. The numbers he observed together he judged to be about thirty, huddled thickly in company in a shallow part of the stream with a gravelly bottom; into which they had dug a small hole, and were evidently employed in shedding their spawn. This was in March; and being desirous of obtaining some of them, by a sudden sweep he threw out of the current about a dozen; in doing which a considerable quantity of the spawn was received into his hands. The rest of these fishes immediately dispersed, and he did not wait to know whether or not they assembled again. When caught and placed in a tank it will throw itself over the brim, but cannot be kept alive long in confinement.

PLANER'S LAMPREY.

Petromyzon Planeri, Cuvier. Jenyns; Manual, p. 522.
" " Yarrell; Br. Fishes, vol. ii, p. 607.

This species bears a near likeness to the Silver Lamprey and the Lampern, and on this account there is no doubt it has been overlooked by observers, although the difference when pointed out is sufficient readily to distinguish them. Its peculiar habits have been less noticed than those of others of this family; but having kept alive a couple of them, which had been taken, with many of the Mud Lamprey, in the Trelawny branch of the Looe river, I was able to discern a peculiarity in the manner in which they deal with their prey, after which I suppose them to be not a little eager. After four or five days the smallest of the two was seen to have a wound at the origin of the dorsal fin, and a considerable space of the skin of one side was excoriated; which I felt no doubt to have been done by its companion; and on the eighth day a further injury of the same sort was inflicted; in both cases it appeared to have been done in the night. On the ninth day both were found dead, and both of them bore the same marks of injury, which was widely spread, but little more than skin deep. They did not at any time appear active; at least they were less so than the Silver Lamprey; but when at rest they adhered by the mouth to a fixed substance, which is not usually the case, if ever, with the Mud Lamprey. This species seems widely distributed, as well in Britain as on the continent, except in the more southern portion of the latter.

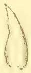
Planer's Lamprey is thicker in proportion to its length than the Silver Lamprey; but it is more decisively known from this and the Lampern by the close approach to each other of the dorsal fins; while in the others there is an evident separation between them.. It has been called the Fringe-lipped Lamprey,



1. PLANER'S LAMPREY. [illegible] LAMPREY. [illegible] BORER. 1. LANCELET, (enlarged.)

[illegible]

from a row of tendrils which encompasses the mouth, but this requires explanation. In the Lampern, as we have represented it, there is a border at the same place of very numerous but slender threads; but in our examples of Planer's Lamprey there was only a single row, and each filament was wide at the base, ending in a point; the surface red, but of a deeper colour along the middle of the length; and it is remarkable that soon after death these filaments were scarcely or not at all to be discerned. The armature of this species bears a resemblance to that of the Lampern and Silver Lamprey; a row of very small teeth round the lower portion of the entrance of the gullet; two larger teeth above, separate, and another of about equal size outward from each of these; below them on each side a pair, and below them again, nearly on a level with the first-named row, another pair on each side.



AMMOCŒTES.

The upper portion of the mouth forms a half circle, united to a crossed portion or lip below; the mouth not capable of being closely shut. Dorsal fins close together, and the hindmost continuous with the tail and anal fin.

MUD LAMPREY.

BLIND LAMPREY. PRIDE.

Lampetra cæca,	Willoughby; p. 107, Pl. G 2, f. 1.
" "	Ray; Synopsis Piscium, p. 36.
Petromyzon branchialis,	Linnæus.
" "	Loudon; Magazine of Natural History, vol. v, p. 23.
Ammocœtes branchialis,	Fleming; Br. Animals, p. 164.
" "	Jenyns; Manual, p. 522.
" "	Yarrell; Br. Fishes, vol. ii, p. 609.

This little fish departs but in a small degree in likeness from the general family of the Lampreys, but it differs from most of them in its characteristic habits; and especially in its little disposition to wander from its accustomed haunts, or its place of shelter and concealment; which is in the beds or accumulations of sandy mud at the border and eddy of the smaller brooks; and from which it seldom emerges; so that however numerous, it would scarcely be known if not sought for by fishermen to serve as a bait in *whiffing* for Pollacks. Buried in scattered companies in the soft soil, it may be said to lead the life of the mole; and it is there it finds all it wants of food; in search of which by taste or scent it moves through its tracks as appetite or disposition prompts; and from observation it may be judged that except in search of new feeding ground, it never willingly exposes itself to the dangers of a rapid stream, the strength of which it might scarcely be able to stem, or to the appetite of any prowling inhabitant of the river; from which its powers would not enable it to escape. How well it can live buried in a soil fitted to its wants will appear from trials to which it has been subjected.

An example was procured at the beginning of April, and at first kept in a pint measure of clear water, where it sometimes shewed activity, or rather a restless disposition, as we often see with large numbers in like circumstances; but also it often lay as if dead at the bottom, on its back or side. Some of the usual mud was then taken from the rivulet and placed at the bottom of the vessel; into which it soon buried itself, and there continued without being seen above it again until the middle of December; at which time it appeared to have become a little more slender, perhaps from deficiency of food; but not less lively, and after this it was set at liberty. On another occasion a few of these fish were placed in a glass vessel, with the usual river mud at the bottom. Two of them, of larger size, were for a time usually in sight, and sometimes active, but the others continued hid in the soil; nor was the water changed for the last six months of their imprisonment; and only a little was added to supply the loss from evaporation; but from August to the following June they continued alive, and at last one of them was enclosed in a box with some green seaweed that had been washed in fresh water, and sent to my friend Mr. Yarrell; who received it still alive after a confinement of thirty-six hours.

A couple of these fish were kept for several hours in clean water; and when a rather tenacious mud was added, from a millpool, one of them became buried in it in a quarter of an hour, and the other in twice that time. This soil did not appear congenial to their habits and motions, but they continued within it, except that for a time their heads were often brought above its surface, and openings were formed opposite the breathing holes, and one of them remained in health, entirely within the mud for several weeks. In a large pan of water a considerable number hid themselves beneath the flat stones which were placed at the bottom; but in all cases a small degree of disturbance excites them to action, and they seek to escape from it. That they can survive the contact of sea-water appears from the fact that the tide is known to flow at times over a place where they lie hid; and they live longer on the hook at sea than the Silver Lamprey is known to do.

This fish is widely distributed in Europe, and even in the north; although it has been said that it is not known in Britain north of the Tweed, and it is not noticed by Nillson among the fishes of Scandinavia. But I am informed by Mr. Peach that it is common at Wick. It is classed with the fishes of Hungary by Dr. Reisinger. Its time of shedding spawn is in the spring, and an instance is known of its having done this in captivity. The grains were white, and in size a little less than those of a lobster; but it is probable that they were not fertile.

The usual length of this species is about six inches, with the circumference of a large goose-quill; but the enlargement is greater along the course of the gill openings. The expansion of the mouth is not circular; but the upper lip is wide, arched into a half circle, and capable of complicated motion; in life well charged with blood-vessels; the lower lip lying across, and it is believed capable of being thrust forward considerably, or rather lifted up, so as with the aid of the sides of the lips to cover the orifice of the gullet. The teeth are not firm, but they exist; a wide border of small ones above, and behind a pair of larger, a pair much larger below. A curious action is seen in life at the place where the passage from the forehead communicates with the gills; and by which it is probable the water for breathing is supplied to the branchiæ, as a substitute for the ordinary gill-covers of other fishes. The orifice on the head is far forward. The orifices of the gills are marked with circular lines, each having its own blood-vessel, and which also are discerned at regular intervals along the body; the body itself round until behind the vent, where it is compressed. The eyes are small, and not to be discerned without much attention, situated in a depression, which resembles a channel forward and backward; with a projection above them which serves to guard and also to conceal them. The vent is far behind, opposite an early portion of the second dorsal fin. The first dorsal begins at about the middle of the length, and is narrow; sometimes so much so as scarcely to be discerned; the second a little removed from the first, wider near its beginning, and then narrower where joined to the caudal fin, which passes round the body and forward half way to the vent. The colour dark yellow on the back, with sometimes a tinge of green; yellowish below, and on the fins. The openings of the gills, which are in a sunken channel, and sometimes the lower portion of the body opposite them are often a lively pink.

An irregular formation has occurred in this fish, in the division of the body into two separate portions from the part just above the vent backward. Both of these portions were bent down from a straight line, and one of them was a little longer than the other, and more active, but the other was more in the right line of the vertebral direction. The shortest was also a little irregular in shape, and bent at the caudal extremity. A faintly-marked first dorsal fin lay a little before the separation of the vertebræ into two columns, and the second dorsal is turned round in a circle at the place where the portions of the body divide, as if this fin was directed down one of the parts and up the other. These two parts of one body diverged to some considerable extent. The fish was about half the usual size, and active.

It should be observed that the eyes ot the Mud Lamprey can be noticed only when the fish is alive, as presently after death they are scarcely or not at all to be discerned. The teeth also, as being of a soft or cartilaginous substance, can be made out only during life.

GASTROBRANCHUS.

The mouth terminal, oval, with tendrils; no eyes. Body lengthened, lax. Breathing holes a pair, near each other, on the lower part of the body at about the first third of its length.

BORER.

MYXINE. HAGFISH. RAMPER EEL. POISON RAMPER.

Myxinè glutinosa,	Linnæus. Fleming; Br. Animals, p. 164.
" "	Jenyns; Manual, p. 523.
Gastrobranchus cæcus,	Bloch. Turton's Linnæus. Cuvier.
" "	Yarrell; Br. Fishes, vol. ii, p. 612.
" "	Its internal structure—Bloch; Schneider, pl. 104; and Yarrell.

This creature bears so little resemblance to a fish that several eminent writers, and among them Linnæus, have judged it proper to class it among the worms; and although on closer examination the generality of naturalists have decided that in its affinities it stands in nearer alliance to fishes, and especially that in a descending scale it bears a close alliance to the family of Lampreys, yet there are so many peculiarities in its formation and prominent appearance, that we can place it only on that intermediate ground which leads from one of these great families to the other; while in some respects it seems to stand alone, as well in its structure as habits, as if to shew, as we have elsewhere observed, that a single presiding influence has been the creator of all, and while establishing the specific nature of each, has still united the apparently discordant characters of the separate individuals into one harmonious whole.

In its more usual range the Borer or Myxinè inhabits the northern seas of Europe, but it is scarcely rare in some districts of our own island, in the northern waters of which, and especially about Scarborough, it is known to fishermen from the injury it inflicts by destroying the fish which have been left on their bulters or long lines for a sufficient time to have become dead, and thus presenting themselves as an unresisting and inviting prey; for there is reason to suppose that the appetite of this fish is only disposed to feed on such as are lately dead, but which have not yet suffered decay or putrefaction. The Cod, Ling, and Haddock are frequently thus the subjects of its depredations; and the Mackarel also, when it has fallen to the bottom from the net. Sometimes, however, it has chanced to be the victim instead of the devourer, and it has been found partly digested in the stomach of a living Cod, an instance of which among others is mentioned by W. P. Cocks, Esq., as having fallen under his notice at Falmouth. But this fish must be regarded as of exceedingly rare occurrence on our south or west coast, as also in Ireland, where it is barely mentioned by Mr. Thompson, but who refers to the remarkable fact that an instance had been known where it had been taken with a hook.

The fullest and most satisfactory account of this fish is contained in the Swedish work of Fries and Ekstrom; from which therefore the principal portion of our materials is derived; but our figure and description in addition are from nature, and for these it is with pleasure we own our obligation to Edmund T. Higgins, Esq., from whom our example, of remarkable size, was obtained.

Ekstrom observes that the Myxinè is common on the west coast of Sweden, and along that of Norway up to the North Cape; but it is not known in the Baltic; and it is singular that the males of this fish have not yet been discovered, nor the young ones of either sex of a less size than about nine inches in length. The reason assigned for this is built on the supposition that neither of these are as predaceous as the females of full growth, or perhaps that their food is different; but the adult females are ravenous in a high degree; and although beyond doubt there are times when they must feed differently, as we have noticed in the fact that they have sometimes taken a bait, although this is seldom; yet their favourite method of feeding is by entering into the body of a dead fish; where they fix themselves, and in no long time devour the whole of the soft materials, so as to leave nothing but the bones and skin, which remain untouched. One or two of these creatures may be sufficient to effect this destruction; but where the victim has been left long to them, no less than twenty have been found within a single fish. And the manner in which the entrance is effected is not less remarkable than their conduct when within the body of their prey. It is not by boring a hole like the Sea Lamprey, nor by tearing the outward surface like many other fishes, but a passage is accomplished through the gills, so that the victim bears little mark of the injury until the skin is found to contain nothing but the bones; (an effect sometimes produced also by the depredations of a multitude of sessile-eyed crustaceans.)

This fish is particular in the choice of the ground on which it lives; which is not that which is sandy; but it gives a preference of what is of clay or mud, and usually in deep water; as from thirty even up to seven hundred fathoms. It is said to move into a less depth in winter, but it never comes near the shore. The appearance of this fish is sufficient to shew that its movements are slow; and if placed in water it lies at the bottom as if dead; but when stirred to exertion it swims for a time like an Eel, but always at the bottom; and it cannot be made to rise above it.

The spawn has been found enlarged in February, and also in July; and Ekstrom thinks that they breed throughout the summer; but the number of grains is few, and no more than twelve have been found enlarged at one time in the ovary, which is attached to the right side of the intestine. A remarkable part of the character of this fish is the enormous quantity of slime which is produced from its pores, and which in a state of liberty must tend to preserve it from some injurious influences. A single individual that was placed in a quantity of water equal to from three to four cubic feet, was found to fill it with this slime so entirely, that the whole could be lifted out with a stick in a single sheet.

The example we describe was in length fifteen inches and a half, which is the largest on record, and two inches round where largest, which was about three inches from the snout; the body soft, flaccid, round until near the tail, when it becomes compressed. On the anterior portion of the body an appearance of rings; breadth (or depth) near the tail six eighths of an inch. Aperture of the mouth perpendicularly oval, with short rather thick tendrils, (a particular description of which will be copied from Eskstrom.) A single projecting hooked tooth above; what are described by writers as lingual teeth appear to me to be pharyngeal; in two nearly half-moon-shaped beds; in two rows of sharp teeth, the outermost or convex row largest, and the uppermost tooth in each row bifid; no mark of an eye. There is no fin on the back until near the tail; a raised fold at the belly, beginning at five inches and a half from the head, and becoming wider as it passes on, it joins the dorsal to form the tail, as in the Conger; but without rays, and resembling the fins of the Lamprey, except that it is much thicker. Two small openings, which communicate with the breathing organs near each other at four inches from the snout, close on the belly to where the abdominal fold begins. The mucous orifices so conspicuous in the figure given in Ekstrom's plate, could not be discerned in our example; which may be accounted for by the action of the diluted spirit in which it had been immersed. The colour brown, with a tinge of pink on the back, yellowish on the sides, pale along the abdominal line.

The figure given by Ekstrom is more brightly coloured, and also much more slender than ours; in which it resembles that of Mr. Yarrell, whereas our own bears a nearer resemblance to that of Pennant; but we believe that the difference is only the effect of the difference of age, and perhaps of feeding. Ekstrom says the usual length is about a foot, slender, plump, round on the fore part, compressed behind, without scales, the skin tough, loose on the body, when alive somewhat pellucid, and plentifully covered with slime; the head to be distinguished only by having the mouth and nose; snout subconical, rather blunt, flat below; the mouth resembling a rounded opening, which closes in folds, without distinct lips. There are eight short barbs ranged round the opening of the mouth, four of which are placed so as to form a square at the point of the snout, and directed upward; two also on each side of the mouth, the lower pair the shortest, but all directed upward. The caudal fin lower on the fore part, and then wide, below reaching forward to the vent, which is at the last eighth portion of the length; the opening longitudinal, large, its length being the half of the height of the body. Rays of the fin very numerous, slender; those along the ventral line directed backward, on the back curved, and at their points turned almost forward. There is another fin, which may be termed preanal, between the vent and the gill openings, formed of a fold of the skin, which at its base contains a large number of very short rays, but stout and blunt. While the fish is alive this fold of the skin is moderately high, but when the body is distended with roe, or when preserved in spirit, it becomes contracted and low. The lateral line is at the sides of the belly, and contains large glands, one hundred and eight in number, just below the skin, but lifting it up and forming a beaded row, with an open pore on the upper side, from which the slime is poured out. There are no distinct teeth in the jaw, but some are deeply concealed within the mouth. At its upper part is a single slender, strong, and curved tooth, which is broad at the root and covered with a fold of skin. The lower teeth are in regular longitudinal rows, bent on each side, and two rows answering to each other. In the outer row are eight, with sometimes another of small size; in the inner row from eight to ten, the two foremost stouter than the others.

The nasal openings are among the barbs on the snout, and are covered with a lobe above; passing into a nasal cavity that is marked with longitudinal folds through a cartilaginous tube marked with a ring; (Mr. Owen says with rings like the windpipe;) and from thence to the entrance of the gullet, where is a valve, and through which the water for breathing passes into what we may term the gills; so that, as this author supposes, there exists in this fish a sort of structure through the nostrils to what is equivalent to the gills, which is not found in any other. But it appears to me that the difference in this respect between the Borer and the Lamprey is rather in the circumstances than the essentials of this organization; since the opening on the head in the one performs the same function as what are termed the nasal openings in the other, and both of them afford the means by which water is conveyed to the gills; but in the case of the Borer, as perhaps in the Lampreys, there are some organic formations, as a veil to the palate, and some smaller veils of a similar kind, which must greatly assist in rendering acute the faculties of smell and taste, and perhaps in directing the inhaled current of water. At the hindmost half of the gullet there are six small openings, regularly arranged on each side, which communicate each by a tube with an equal number of membranous vesicles, a little compressed, and of the diameter of the fifth or sixth of an inch, the lining of each of which forms considerable folds, which serve in the place of gill-plates for performing the function of breathing; the water passing from the gullet through these tubes to the vesicles or gills, and from them, on each side by passages uniting into a tube, the water is discharged by a couple of openings, close to each other on the belly; and which therefore are truly the breathing holes or external gills, and taken as a whole nothing can be more wisely contrived for keeping in store and supplying the necessary fluid in a creature which occasionally for a long time cannot obtain a renewal of the same from without. These outward openings of the breathing organs are behind the muscular apparatus of the tongue, which is large and turned far backward, reaching from the gullet to the openings, and in thickness is equal to half the diameter of the body; its action being directed by several powerful muscles, which, with the help of the grating teeth, will act on the food like a file, while the single tooth on the palate is employed in fixing the mouth of the devourer on its prey; a structure and action not much unlike what is common in a large portion of osseous fishes.

Mr. Owen remarks that the whole of the anterior parts, as the muscles and integuments of the head, the barbs, nasal tube, membrane lining the mouth and tongue, and the teeth in the throat, with the pharynx or passage leading to the gullet, are furnished with one common nerve, termed the fifth pair, from which they obtain a high degree of sensation of a peculiar kind. And singular, as well as effectual, as this inward organization appears to be for the special habits of this fish, the structure of the spine seems scarcely less so as compared with that of other fishes, but as such suggesting an opinion of a very low degree of intelligence. Connected with this Dr. Roget observes, in his Bridgewater Treatise,—"There are few parts in the structure of animals that exhibit more remarkable instances of the law of gradation than the spine of fishes, in which we may trace a regular progression of development, from the simplest and almost rudimental condition in which it exists in the Myxinè and the Lamprey, to that of the most perfect of the osseous tribes. Its condition in the former of these animals presents a close analogy with some structures that are met with in the molluscous, and even in annulose animals. So near is the resemblance of the spinal column of the Myxinè, more especially, to the annular condition of the framework of the *Vermes* (worms,) that doubts have often arisen whether that animal ought not to be ranked among this latter class; for in place of a series of bones composing the vertebral column, it has merely a soft and flexible tube of a homogeneous and cartilaginous substance, exhibiting scarcely any trace of division into separate rings, but appearing as if it were formed of a continuous hollow cylinder of intervertebral substance, usurping the place of the vertebræ, which it is the usual office of that substance to connect together, and having in its axis a continuous canal filled with gelatinous fluid. The nervous cord is on the outside of this column, and the cartilage forms no canal for its passage and protection," as is formed by bony processes in the higher orders of fishes. "The nervous matter here consists merely of two slender cords, which run parallel to each other in a groove on the upper part of the spinal column; and these cords are only covered by a thin membrane, the presence of which it requires very minute attention to detect. As we ascend from this rudimental condition, which resembles that of the cuttle (*sepia,*) we find it in the Lamprey more distinctly divided into rounded portions, which appear like beads strung together, or like rings with a canal throughout the whole. There is also a skull to hold the brain, which, as in other fishes, does not fill the cavity, which on either side contains a considerable space that is occupied with an organ of hearing; but while there are nerves from the brain, as in other fishes, that important portion of the brain, the cerebellum, is absent."

Ekstrom says that the colour of this fish is greyish flesh-colour when alive.

AMPHIOXUS.

The body compressed, without scales; mouth on the under part of the head lengthwise, and its border on each side within with tendrils. One fin along the back, joined to the anal to form the tail. No other fin.

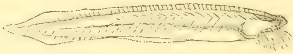
The name *Amphioxus* was bestowed because the fish thus characterized appears as if sharp at both ends. It has also been termed *Branchiostoma,* from a supposed position of the gills at the mouth.

LANCELET.

Amphioxus lanceolatus,	Yarrell; Br. Fishes, vol. ii. p. 618.
" "	Loudon's Mag. Nat. Hist., 1838. p. 38.
Branchiostoma lanceolatum,	Gray; Cat. Br. Museum, p. 150.

If the Borer, or Myxinè exhibits in its structure and habits a wide departure from the ordinary race of fishes, the Lancelet does the same in not a less degree, although in a widely different direction; while in both instances a mistake has been made in reference to their proper station in nature. Pallas was the first naturalist who had an opportunity of examining the fish now called the Lancelet, but it was under unfavourable circumstances; and hence he was led to arrange it among the mollusks, under the name of *Limax lanceolatus;* but as the correction of this error forms a portion of the history of the fish itself, it is proper we should relate the manner in which that correction has been obtained. The example possessed by this eminent naturalist was sent to him from Cornwall, which circumstance may be explained by believing that it was obtained by him, with other natural productions, from John Hawkins, Esq., who had travelled much on the Continent, and in so doing had cultivated acquaintance with the more eminent naturalists there, to whom on his return he was liberal in sending contributions. His name has been mentioned already in connection with Bloch, and the species of *Gymnetrus* named from him. But the little animal now named the Lancelet remained in doubt until it was, in the more proper sense, discovered in the harbour of Polperro, under circumstances which form a characteristic portion of its natural habits.

In December, 1831, there had been a severe storm, when I proceeded to examine the beach for the purpose of observing what had been its effect in throwing on shore the produce of the ocean. At nearly low water the tide had ebbed about fifty feet from the place where lay a flat stone on a small accumulation of sand, and on removing the sand I perceived the tail of a little fish, the body of which was concealed beneath. When removed from its hiding-place, and placed in a pool of water, it appeared new to me, although its active motions prevented for a time the distinguishing its head from the tail; but when these energetic actions ceased it fell to the bottom and remained without motion. While yet alive, the figure was drawn which now forms its portrait; and this is selected the rather as our other figure, from an example of larger size, is from a specimen also thrown on shore in a storm, that was dead when it was found. The example first referred to, after being long preserved in diluted spirit, was the type of the figure by Mr. Yarrell, and the second is in the collection of the British Museum.



No other evidence than the places in which these examples were found, with a close inspection of their characteristics, was necessary to shew that their residence had been at, and concealed within the bottom of the sea, and, in these instances, not far from the places at which they were found; and this has been proved since in a large number of instances; for the Lancelet has now been obtained in the Mediterranean, and round the British coasts up to the far north, even at a considerable depth of water; but wherever procured it has always been as buried in the sand of the bottom, from which it has been taken by the process of dredging. It may be doubted whether it ever rises entirely and willingly above its hiding-place, although a portion of its body may be at times protruded; and as it is altogether destitute of eyes, however sensitive otherwise to impressions of touch or motion, it seems but little fitted to a life aloft, where it would be exposed to perpetual hazard from the devouring inhabitants of the sea. Within its narrow sphere, however, it may be capable of considerable activity, as well as of enjoyment, for which, by some peculiarities of organization it seems sufficiently provided. What has been noticed of its motions in captivity is here brought together; but the principal interest attached to this fish is derived from its very singular structure, which, while it tends to place it lowest in the scale of descent, affords also some particulars in which it claims a higher place, at least than the Borer; and in a physiological view it stands distinct from every other.

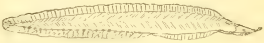
In "The Naturalist" for 1852, p. 30, Mr. Lukis, of Guernsey, gives an account of a specimen of the Lancelet which he caught at the Island of Herm, and kept alive for several weeks. Himself obtained it at low-water mark by having his attention directed to it through its actions. Although not possessed of eyes, it shewed great sensibility to light (for which its large although concealed optic nerve will account) when a candle was brought into the room. Its activity was so great that it jumped out of the bowl in which it was kept; and it darted into the sand with great ease and swiftness; but when not disturbed it rested at about half an inch below the surface of the sand, inclining a little on its side. Dr. Vigurs at Falmouth remarks of an example two inches in length, taken as this fish usually is, by dredging, that it was very active, its motion being like that of an Eel; it burrowed in the sand, and often protruded about half an inch of the body out of the sand with its mouth upwards; it always swam with the ventral margin and mouth uppermost; and when moved from its lurking-place it rapidly returned to it. If disturbed three or four times in succession it lay on its side without motion; a circumstance which goes to prove that this very active motion is soon followed with fatigue, as is also shewn by W. P. Cocks, Esq., also of Falmouth. This gentleman observes that his example swam rapidly with a wriggling or snake-like motion for a second or two, and then suddenly settled down at the bottom of the vessel; where it would remain motionless, lying flat on its side with its mouth open, and to all appearance dead, for thirty or forty minutes, or longer if not disturbed. Two days after its capture he put a quantity of shell-sand in the vessel, which alarmed it, and for a few seconds it swam with increased velocity, and then suddenly disappeared in the bed of sand at the bottom of the glass. In fifty minutes from this time a third part of its body appeared above the sand in an upright position, and quite still, with the mouth open, and the filaments slightly bent at their extremities; but on agitating the water with a piece of straw the body was partly drawn in; and on repeating the annoyance it disappeared altogether. Mr. Cocks adds that he carefully watched this little creature, with the assistance of a pocket-lens, at every hour in the day for eight days, without having had an opportunity of seeing more of it above the sand than the open mouth and reflected filaments; as if patiently waiting for its prey.

The largest example of this fish which I have seen was in length two inches and three tenths, with a depth of three tenths of an inch, exclusive of the fins; the body sharp at the tail, but less so at the head, as the generic name might lead us to suppose; the body and head so transparent that the inward structure can be discerned; and what renders this little creature highly curious is the fact, that with a vertebral column or backbone distinctly made out with its separate joints, there is no separate skull, so what little appearance of brain there is can only be compared to what is found in creatures that have no vertebræ; and especially to that very inferior class of ringed animals which bear the name of Entozoa. The jointed vertebræ in the Lancelet are continued forward on the head, even to the point of the snout. The mouth is large and under the head; where it does not lie across, as in other fishes, but lengthwise; and when at rest its inward cavity contains the lengthened filaments, of which ten were counted, but there may be a couple more. They lie crossing each other within the mouth except when in action; and when dead they usually hang loosely outward. The number of lines which may be judged to mark the number of joints in the backbone was sixty; and between each of them and the next were five perpendicular rays of a fin, with two or three anterior to the first distinct line. The anal fin has these rays also, but they become shorter and then disappear, in both the dorsal and anal fin, at about one fifth of the whole length from the tail; beyond which the structure of these fins is simple membrane, as in the corresponding part in the Lamprey; but wider above and below as they approach the tail, and ending at last in a lengthened point.

In the larger example I was able to discern a structure in these fin-rays which appeared extraordinary; since they did not rise from a single root, as in most fishes, but in the form of a transverse arch, in which the curve formed the support of the fin, while its pillars rest on what may be two transverse spinal processes. The rays of the fin are but little raised or depressed, and when not much expanded the fin appears as thick to the extent of these rays. The vent is at the length of one third of the body from the tail, which is to be especially noted on account of what will be observed presently of what may be supposed another species; and close behind the vent the anal fin begins; but further forward, and along the belly, is a fin or fold without rays, which stretches almost to the throat. The abdominal cavity is long and narrow, and in the first-discovered example when alive there could be seen a row through its length of small round grains; which were not seen in others after death. There was a tinge of yellowish colour on the body when alive, with tinted reflections of green and yellow near the tail.

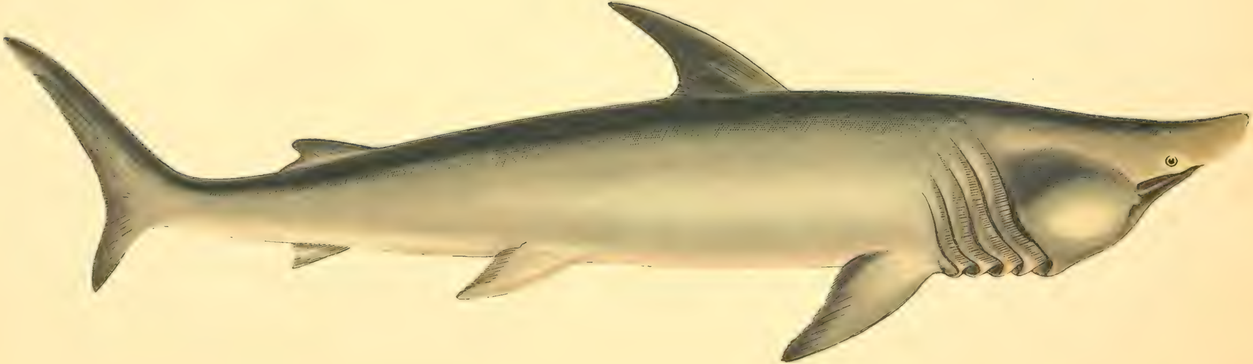
Several eminent anatomists have employed their ingenuity in dissecting this remarkable little fish; but we can only refer briefly to the descriptions they have given us. With the appearance of separate joints in the backbone, Professor Owen says that this entire column consists only of the gelatino-cellular chord and its membranous sheath; and from what we have termed the brain the fifth nerve distributes fine threads to the head, opening of the mouth, and the filaments that belong to it; thus supplying those parts with quick sensation; but the fish does not appear to be endowed with what are termed organs of special sense; although there appear to be parts within the cavity of the mouth that are capable of the sense of taste. The filaments at the mouth appear to be organs of prehension, to convey the food to the entrance of the gullet. It is said to be without gills, although there is a structure in the gullet which answers the same purpose; and Professor Huxley says that it does not possess a proper heart; but it has several contractile dilations for circulating the vital fluid.

Such is our account of the Lancelet as it is usually seen; but there has been a variation of structure in some one or two examples met with, which impresses the persuasion that they are of a separate species, although of the same genus; for where in the species already described the vent is at the hindmost third part of the length, in the instances referred to this aperture is about the anterior third part of the body. I build less on the fact that the head in this supposed species

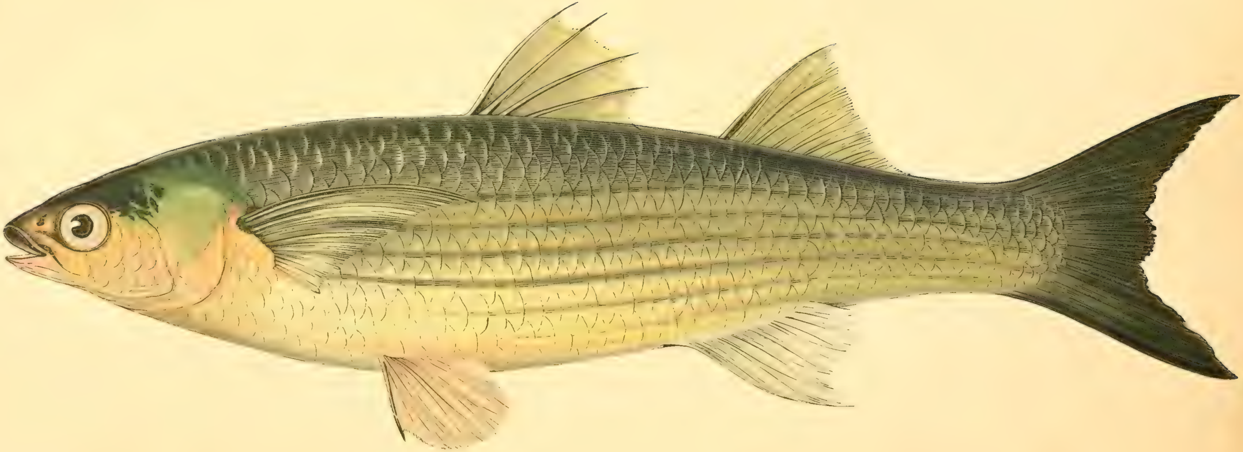


is far more sharp and slender, since this may have been the result of accidental injury to the specimen; but the dorsal fin begins further back, is less expanded posteriorly, as is also the anal, and where they unite to form the tail the membrane is short and blunt, and not extended to a point, as in the kindred fish. As the vent is far forward the lengthened abdominal fin is so much the more so, and it is carried on to near the mouth; and, unlike what I have ever seen in this fin in the former fish, in this instance it has rays, which however extend to only half the breadth of the fin itself, the border being formed of membrane only; and the anal is without visible rays. From the vent to near the tail, along the base of the anal fin, is a row of separate points. The example here particularly described was received from Glasgow by the kindness of David Robertson, Esq., who remarks that it was retentive of life; and the question arises whether this is the *Branchiostoma lubricum* of Dr. John E. Gray's "List of Specimens of Fish in the British Museum," p. 150, a native of the Mediterranean.

Δοξα Θεω εν υψιστοις.



BROAD-HEADED GAZER.



LONG-FINNED GREY MULLET.

[illegible]

APPENDIX.

In the first volume of this work we have given an account, with a figure, Plate XV, of a species of Shark, which we have called the Broad-headed Gazer, and which is otherwise not known to naturalists. But the resemblance was less satisfactory than could have been wished, and therefore another likeness is now provided, from the same example; for which we are indebted to the kindness of John Gatcombe, Esq., of Plymouth, for whom it was drawn by a friend. The dimensions of this fish were—the length from the snout to the beginning of the tail twelve feet six inches; length of the longest part of the tail three feet six inches, of the shortest lobe two feet; widest extent of the tail four feet five inches. From the snout to the beginning of the first dorsal fin five feet seven inches, length of this fin one foot nine inches, its height nineteen inches; distance between the two dorsal fins two feet seven inches; length of the pectoral fin two feet five inches. The elevation of the upper jaw is remarkable, as also the small size of the nostrils and eye.

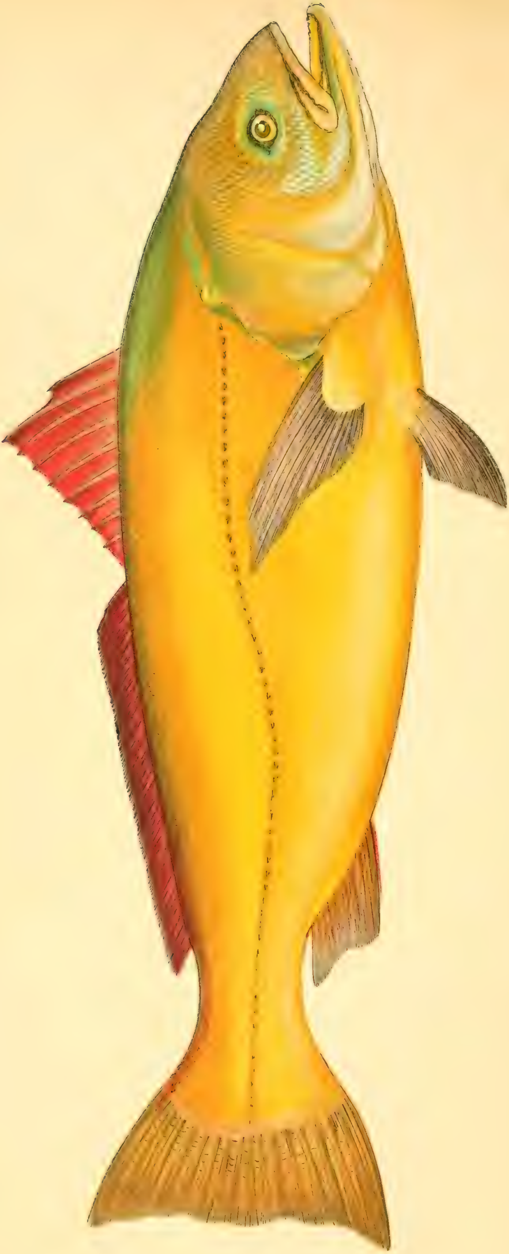
LONG-FINNED GREY OR GOLDEN MULLET.

In our third volume, page 19, there is a short reference to this fish, which from information that has reached us we believe to be less rare than has been supposed. We have now the satisfaction of adding a figure of it, obtained from an example taken in the Mount's Bay.

GARFISH.

(Plate CCIX, vol. iv, p. 146.)

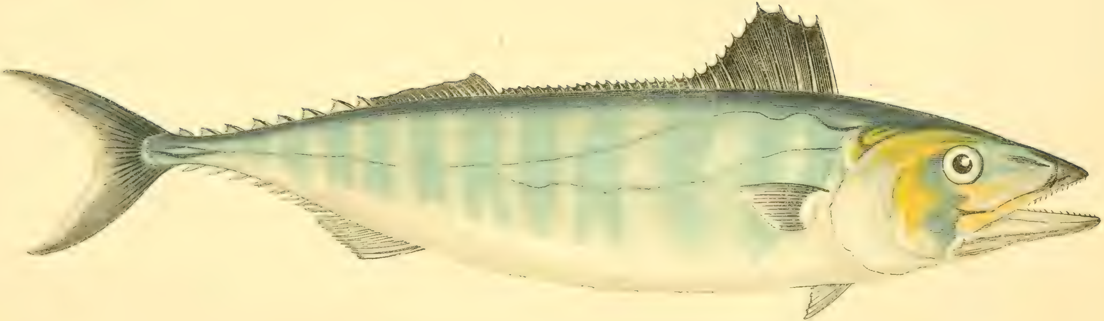
The habits of the Garfish are supposed to be well known, but there is a trait in the character of this fish which has lately come to light, which represents it as more irascible or ferocious than has been usually believed, and as conscious of powers we should have scarcely believed it to possess. An example of a Mackarel was sent to me from Mevagissey, by the kindness of Mr. Matthias Dunn, already mentioned, which had become entangled in the meshes of a drift-net, but which had already suffered from the furious attack of a Garfish. This latter must have rushed at its victim with all its powers, so as to thrust its projecting jaw through the body of the Mackarel at its thickest part, which is close above the pectoral fins, where the upper mandible was broken off close to the head; while the point protruded on the other side to the extent of about the fourth of an inch. The lower mandible had been withdrawn, and the wound must have been inflicted a few days before the capture of the Mackarel, since the wound itself had not the appearance of being entirely new. This incident will explain the fact that the Garfish is sometimes caught with a deficiency of both the jaws.



SCIÆNA.

In our second volume, Plate LXXVI, there is a representation of this fish, with a description, which were obtained from an example that had faded from what is the usual appearance of this species when first caught; it is therefore judged more satisfactory to supply a figure from an example which has been obtained more recently, together with a description that will be found more minutely particular than is elsewhere to be found.

This fish was taken at Looe, in a Mackarel sean on the 10th. of July, and measured in a straight line fifty-six inches; depth of the body fourteen inches; the head rounded in front, blunt, stout; jaws nearly equal, lips full, with a stout mystache; teeth rather low, scattered, none at the symphysis; tongue large and free; a thick membranous veil in front above; all within the mouth a bright yellow colour. Eyes of moderate size, the bony border above and round them prominent; three nostrils on one side, which character is of course abnormal; lateral line with a gentle sweep. The body, cheeks, and head to the front covered with scales, which are large on the side, and directed more obliquely than is usual in fishes. The border of the first gill-cover is usually described as serrated, but in this instance there was not the slightest appearance of serration; and I remember to have seen an example, in company with Mr. Yarrell, where also there was scarcely a mark of irregularity at that part. At the hindmost gill-cover was a loose membranous border, which was particularly extended at the root of the pectoral fin; also a thick fleshy substance over or on the inside of the root of this fin. Ventral fins thoracic. The first dorsal fin begins over, and almost before the root of the pectoral, with nine stout rays; second dorsal near the first, even in breadth, with thirty rays; pectoral rather long, seventeen rays, lengthening to the eighth; the anal, with eight rays, begins opposite the middle of the second dorsal, and scarcely passes to the end of that fin. Tail a little incurved, with twenty rays; all the fins and their rays stout. The scales on the border of the membrane, extended from the hindmost gill-cover, are small and huddled together; between the rays of the caudal fin there are also small obscure scales. The pores along the lateral line are irregular; some being at the angles, and some at the middle of the scales. Colour of the body generally a rich bronzed yellow, with tints of golden; light green in front of the first dorsal fin and part of the head, also over the eye; light tints of golden verging into silver on the cheeks. First dorsal fin brilliant pink red; pectoral strong dark purple; second dorsal pink purple; ventrals and anal a neutral tint; caudal dark with a tint of red.



SHORT-FINNED TUNNY.

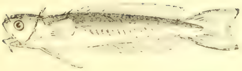
LXXXII*

SHORT-FINNED TUNNY.

Thynnus brachypterus,	CUVIER.
" "	GUNTHER; Catalogue Br. Museum, vol. ii, p. 363.
Pelamys vera,	RONDELETIUS; p. 245; but he supposes it an early condition of the Tunny; and it is to be observed that it is not recognised by Dr. Gulia, in his "Tentamen, or Reportorio of the Fishes of Malta," at least as being distinct from the *Thynnus Brevipinnis* of the same author.

THIS fish is a native of the Mediterranean, where perhaps it is equally common with the Tunny, with which it appears to have been confounded until distinguished by the discriminating examination of Baron Cuvier. But it appears to be less a wanderer into the ocean than that fish, and there is no record of its having been caught in the British seas until the summer of the present year, 1865; when an example was discovered among the numbers of small Mackarel taken near Mevagissey, in Cornwall, in the drift-nets, and sent to me by Mr. Matthias Dunn, an intelligent fisherman of that place. This first example was obtained on the 18th. of August, and it is worthy of notice that within a week afterwards a specimen was taken in the same manner by a fisherman of Polperro; and in the first week in September three other examples were sent to me from Mevagissey; thus amounting to five examples in the course of a month within a limited extent of our south coast; which circumstance appears to shew that they have been bred at no great distance from our shores. The size of these examples also goes far to prove the same fact, as the first measured only six inches from the snout to the fork of the tail, and the three last had only reached the length of eight inches. Our figure is taken from the first example, and the description from a comparison of the whole of the number thus referred to.

Compared with a Mackarel of the ordinary size the body is stouter, and the head conspicuously so; but the body becomes proportionally more slender near the tail; where in the smaller individual the lateral carina or ridge was obscure, but in the others well developed; no scales to be discerned on the body, but an irregular corset along the side of the back, which in the larger examples was scarcely to be discerned; the lateral line begins above the root of the pectoral fin, and is irregular in its course. The snout protrudes, and the joint which unites the snout to the forehead is much more elevated proportionally than in the Mackarel; under jaw a little in advance of the upper; gape wide; teeth conspicuous and strong; eye rather large; many small lines running backward from the hindmost border of the eye and end of the mystache; nostrils midway from eye to snout. The first dorsal fin begins in a line above the root of the pectoral; in the first example six of its rays were long, the fourth and fifth longest, after which the fin passed very narrow to the origin of the second dorsal; but in three examples the first ray was longest, and the decrease in length was gradual; twenty-four rays in all, their roots in a chink, which was deepest to receive the larger rays; the second dorsal low, as is the anal, the former with fifteen rays, the latter eleven; finlets eight above and below; pectoral fin short and wide, with twenty-three rays; tail much forked, but the rays not counted, from the obscurity of those in the middle. The colour a cast of beautiful blue along the back and upper part of the sides, with fourteen broad circular belts of a deeper tint along the body; tints of yellow in one example on the first gill-cover and behind the head. The first dorsal fin in the larger examples intensely black; the second dorsal, pectoral, and tail dark, the two last with a light border; fins below light; belly silvery.



SILVERY GADE.

At page 116 of the third volume of this work, a reference is made to a small fish, termed by its discoverer, Montagu, the Silvery Gade, but which I had not seen when that portion of our work was published; nor had it come under the notice of observers from the time of its first observer. Since then however I have been supplied with examples from Banff, through the industry and kindness of Mr. Thomas Edward, of that place; and the few remarks which he was able to make on the circumstance attending their capture, will add something to the little that is known of the habits of this fish.

Our figure is from one of the examples thus taken on the west coast of Scotland; about an inch and a half in length, with the general proportions of *Couchia glauca*, but thicker across the head and body; under jaw slightly shorter than the upper, with a conspicuous barb. Eye large, and in front of it two open nostrils, not close together; a short barb rising from the hindmost border of each anterior nostril; this barb smaller than in the Mackarel Midge. Body small at the root of the tail, and ending almost in a point among the rays of the caudal fin. Lateral line visible along the hindmost half of the body, but scarcely so near the head. Tendrils in the chink in front of the dorsal fin numerous, the first longest and most distinct; the dorsal fin passes back close to the tail, as does the anal, and both more expanded behind; tail slightly concave; ventrals close under the throat, with the second ray reaching to the vent. Mr. Edward says that when alive the back was a beautiful pea-green colour; thus shewing a decided difference from our more common species; all besides silvery, the fins pellucid. These fish were caught near the shore late in the month of October; and we cannot suppose that they go far from this district at any time.

INDEX.

A

	Plate.	Vol.	Page.
Abramis Blicca . .		iv	45
Brama . .		iv	36
Buggenhagii .		iv	42
vulgaris . .		iv	36
Acanthias vulgaris .		i	49
Acantholabrus Couchii		iii	38
exoletus . .		iii	41
Palloni .		iii	40
Yarrellii . .		iii	37
Acanthopterygians .		i	165
Acerina vulgaris .		i	193
Acipenser Sturio .	35	i	157
Huso . .	36	i	163
Acus Aristotelis . .		iv	355
lumbriciformis .		iv	361
minor . . .		iv	141
Oppiani . .		iv	146
Agonus Cataphractus		ii	41
Alewife . . .		iv	117
Allis Shad . .	204	iv	117
Alopecias . .		i	37
Alosa finta . . .		iv	122
squamopinnata .		iv	123
vulgaris . .		iv	117
Ammocætes branchialis,		iv	404
(Cæcus) .		iv	404
Ammodytes lancea .		iii	137
lanceolatus . .		iii	140
cicereleus .		iii	140
Tobianus . .		iii	137, 140
Amphioxus lanceclatus		iv	415
Anarhicas lupus .		ii	242
Anchovy . .	206	iv	125
Angelfish . .		i	73
Angler . .	110	ii	204
Angler, Long . .		ii	217
Anguillæ . . .		iv	306
Anguilla acutirostris		iv	326
conger . . .		iv	340
Hibernica . .		iv	328
latirostris . .		iv	330
mediorostris .		iv	331

	Plate.	Vol.	Page.
Aper		ii	142
Aphya . . .		iv	109
Argentine . . .	233	iv	301
Argentina silus junior		iv	297
Arnoglossus lophotes		iii	178
laterna . .		iii	177
Rondeletii .		iii	177
Asellus antiquorum .		iii	62, 129
luscus . .		iii	70
merlucius . .		iii	99
mollis . .		iii	75
niger . . .		iii	80
varius . .		iii	66
Asinus . . .		iii	65
Aspidophorus Europœus		ii	41
cataphractes .		ii	41
Aspro . . .		i	193
Atherine, Boier's	121	iii	4
Atherine, Presbyter	121	iii	1
Auxis vulgaris . .		ii	105
Azurine . . .	197	iv	61

B

	Plate.	Vol.	Page.
Balance-fish . .		i	70
Balistes capriscus		iv	369
scolopax . .		iii	21
Banks' Oarfish .	119	ii	251
Barbel . .	181	iv	16
Barbus fluviatilis .		iv	16
minor . . .		iii	122
vulgaris . .		iv	16
Bansticle . . .		i	167
Bass . . .	40	i	189
Batis intermedia .		i	95
vulgaris . .		i	87
Batrachoides . .		iii	122
Becker . . .	51	i	228
Belone saurus . .		iv	141
vulgaris . .		iv	146
Bergylt . . .	58	ii	1
Bib . . .	138	iii	70
Blackfish . .	123	iv	56
Bladefish . .		ii	61

	Plate.	Vol.	Page.
Bleak	195	iv	56
Blenniops Ascanii		ii	233
Bellonii		ii	224
Galerita		ii	231
gattorugine		ii	219
Montagui		ii	231
ocellaris		ii	224
palmicornis		ii	233
Pholis		ii	226
trifurcatus		iii	122
viviparus		ii	239
Yarrellii		ii	233
Blenny, Butterfly	112	ii	224
Blenny, Montagu's	113	ii	231
Blenny, Smooth	113	ii	226
Blenny, Viviparous	116	ii	239
Blenny, Yarrell's	114	ii	233
Blens—Blinds		iii	70
Blue Poll, *B. Cocks*	216	iv	219
Boarfish	96	ii	142
Bogue	50	i	225
Bonito	83	ii	97
Bonito, Plain	86	ii	105
Bony Fishes		i	165
Boops		i	225
Borer	248	iv	408
Botia tænia		iv	72
Bounce		i	11
Box		i	225
Brama Raii		ii	129
Branchiostoma lanceolata		iv	415
Branlin		iv	245
Bream	55	i	237
Bream, Carp		iv	36
Bream, Common		iv	36
Bream, Flat		iv	40
Bream, Lake	187	iv	36
Bream, Short	56	i	241
Bream, Spanish	54	i	235
Bream, White	188	iv	40
Bream, Yellow		iv	40
Brill	162	iii	161
Brosmius		iii	96
Bubalis	61	ii	11
Buddagh		iv	222
Buglossus		iii	200
Bullhead, Greenland	62	ii	12
Bull Trout	211	iv	200
Burbolt	146	iii	93
Butterfish	115	ii	236
Butterfly Fish		ii	224

C

	Plate.	Vol.	Page.
Callarias		iii	62
Callionymus dracunculus		ii	178
lyra		ii	173
Canis		i	25
galeus		i	15
Cantharus etnaian		i	201
griseus		i	222
lineatus		i	222
vulgaris		i	222
Capito		iv	44
Capriscus		iv	369
Capros aper		ii	142
Carassius		iv	28
Carcharias glaucus		i	25
vulpes		i	37
Caranx trachurus		ii	
Carp	180	iv	4
Carp, Prussian	185	iv	31
Carter	164	iii	167
Catfish		i	11
Catfish		ii	43
Catulus major		i	11
minor		i	14
Centriscus		iii	21
Centrolabrus exoletus		iii	41
Centrolophus		ii	107
Cornish	91	ii	127
Britannicus		ii	127
pompilus		ii	122
Centronotus		ii	236
binotatus		ii	139
Cephalus brevis		iv	369
oblongus		iv	381
Cepola rubescens		ii	262
Cernua fluviatilis		i	193
Cetorhinus maximus		i	60
Chars		iv	253
Char, Alpine	226	iv	272
Char, Cole's	225	iv	269
Char, Enniskillen		iv	269
Char, Gray's	224	iv	267
Char, Willoughby's	222	iv	262
Chimæra, Arctic (monstrosa)	35	i	145
Chrysophrys aurata		i	243
Chub—Chevin	190	iv	44
Ciliata glauca		iii	113
Citharus asperus		iii	153
Clupea alba		iv	114
alosa		iv	117, 122
encrasicholus		iv	125
finta		iv	122
harengus		iv	95
latulus		iv	114
macrocephalus		iv	124
pilchardus		iv	79
sardina		iv	112
sprattus		iv	109
Coalfish	143	iii	84
Cod	135	iii	53
Cod, Variable		iii	66
Cobitis barbatula		iv	68
Comber	42	i	195

	Plate.	Vol.	Page.
Comber Wrass	126	iii	32
Conger	238	iv	340
vulgaris		iv	340
Cook	27	iii	30
Cook, Rock	130	iii	41
Coquus		iii	44
Coracinus		ii	55
Coregonus fera		iv	286
Lacepedii		iv	295
Lavaretus		iv	286
maræmula		iv	289
Nilssoni		iv	286
Pennantii		iv	286
pollan		iv	292
thymallus		iv	280
Wartmani		iv	286
Willughbii		iv	289
Coris julis		iii	49
Corkwing	131	iii	43
Coryphæna		iii	118
pompilus		ii	123
Cottus bubalis		ii	11
cataphractus		ii	41
four-horned	63	ii	15
gobio		ii	6
Greenlandicus		ii	12
quadricornis		ii	15
Schonveldii		ii	41
scorpius		ii	8
Couchia glaucus		iii	113
argentata		iii	116
Couch's Sea Bream	52	ii	231
serranus		i	200
Couch's Whiting	111	iii	77
Craigfluke		iii	190
Crake Herring		ii	138
Crooner		ii	27
Crenilabrus Belonii		iii	45
cornubius		iii	43
melas		iii	43
microstoma		iii	41
quinque maculatus		iii	46
rupestris		iii	47
Crucian	184	iv	28
Ctenolabrus marginatus		iii	47
rupestris		iii	47
Cyprinidæ		iv	1
Cyprinus alburnus		iv	56
auratus		iv	33
barbus		iv	16
blicca		iv	40
brama		iv	36
Buggenhagii		iv	42
carassius		iv	28
carpio		iv	4
cephalus		iv	44
cœruleus		iv	61
dobula		iv	51
erythrophthalmus		iv	49

	Plate.	Vol.	Page.
Cyprinus gibelio		iv	31
grislagine		iv	51
idus		iv	63
jeses		iv	44
latus		iv	36, 40
leuciscus		iv	54
phoxinus		iv	64
rutilus		iv	47
Cuckoo-fish		iii	34
Cyclopterus bimaculatus		ii	198
liparis		ii	190
lumpus		ii	183
Montagui		ii	193

D

	Plate.	Vol.	Page.
Dab	170	iii	185
Dab, Lemon	178	iii	187
Dab, Long Rough	160	iii	153
Dab, Smear	171, 172	iii	187
Dab, Smooth		iii	187
Dace	194	iv	54
Dalatias microcephalus		i	57
Damin Herring		iv	117
Dart		iv	54
Dentex	45	i	203
Derbio	95	ii	139
Discobuli		ii	181
Dobule	193	iv	51
Dogfish		i	49
Dogfish, Black-mouthed	3	i	18
Dogfish, Eyed	3	i	18
Dogfish, Picked	11	i	49
Doree	89	ii	118
Dorse	137	iii	66
Dragonet Gemmeous		ii	173
Dragonet, Sordid		ii	178
Duncow		i	117

E

	Plate.	Vol.	Page.
Echeneis remora	88	ii	112
Echinorhinus spinosus		i	54
Echiodon Drummond's	156	iii	133
Eelpout		iii	93
Eel, Broad-nosed	236	iv	330
Eel, Dublin	235	iv	328
Eel, Ophidium	237	iv	333
Eel, Sharp-nosed	234	iv	326
Eel, Snig		iv	331
Elleck	64	ii	19
Elviris auratus		ii	159
Encrasicholus		iv	125
Engraulis		iv	125
Eperlanus		iv	276
Erythrinus	53	i	233
Esox Belonè		iv	146
lucius		iv	150
Exocœtus exiliens		iv	128

F

	Plate.	Vol.	Page.
Faber		ii	118
Farthing Trout		iv	245
Fatherlasher	60	ii	8
Fierasfer		iv	333
dentatus		iii	133
Filefish	243	iv	369
Fishing Frog		ii	204
Fish Leach		i	90, 92
Flair		i	87
Flatfishes		iii	146
Flounder	175	iii	195
Flounder, Long	174	iii	193
Flounder, Rough		iii	153
Fluke		iii	195
Fluke, Sail	163	iii	163
Flying-fish, Greater	207	iv	128
Fox Shark		i	37
Forkbeard	155	iii	122
Forkbeard, Blennoid	154	iii	128
Forkbeard, Greater	153	iii	122
Forked Hake		iii	122
Frogfish		ii	204

G

	Plate.	Vol.	Page.
Gadidæ		iii	52
Gade, Silvery		iv	427
Gadus æglefinus		iii	62
argenteolus		iii	116
Brosmè		iii	96
callarias		iii	66
carbonarius		iii	84
cimbria		iii	111
lota		iii	92
luscus		iii	70
merlucius		iii	99
merlangus		iii	74
minutus		iii	72
molva		iii	89
morrhua		iii	53
mustela		iii	108
pollachius		iii	80
Poutassou		iii	77
scorpius		iii	96
tricirratus		iii	105
virens		iii	53
Galeus vulgaris		i	45
Garfish	209	iv	146
Gasterosteus ductor		ii	107
pungitius		i	176
spinachia		i	180
Gastrobranchus cæcus		iv	408
Gattorugine	111, 113	ii	219
Gazer, Broad-headed	15	i	68
Gazer, Broad-headed	15*	iv	421
Germon	84	ii	100
Gilthead	57	i	243
Gillaroo	219	iv	240
Glaucus		ii	139
Globefish, Pennant's	244	iv	373
Goatfish		iii	125
Gobites tænia		iv	72
Gobius tænia		ii	152
albus		ii	172
attenuatus		ii	166
auratus		ii	159
bipunctatus		ii	162
capitatus		ii	6
minutus		ii	161
niger		ii	153
paganellus		ii	170
reticulatus		ii	170
rhodopterus		ii	170
Ruthensparri		ii	162
Gobio fluviatilis		iv	20
Goby, Black	98	ii	153
Goby, Broad-finned	101	ii	165
Goby, Little	100	ii	161
Goby, One-spotted	101	ii	167
Goby, Rock	98	ii	153
Goby, Slender	102	ii	172
Goby, Speckled	102	ii	170
Goby, Tail-spotted	101	ii	166
Goby, Transparent	102	ii	171
Goby, Two-spotted	100	ii	162
Goby, Yellow	100	ii	159
Goby, White		ii	172
Goldfish	186	iv	33
Goldfinny		iii	43
Goldfinny, Jago's		iii	47
Gowdie		ii	27, 173
Graining	196	iv	59
Grayling	228	iv	280
Greenbone		ii	239
Gresling		iv	51
Gudgeon	182	iv	20
Guid		iii	1
Guiniad	229	iv	286
Gundie		ii	8
Gunnel		ii	236
Gunnellus viviparus		ii	239
Gurnards	68	ii	17, 27
Gurnard, Armed	71	ii	38
Gurnard, Bloch's	69	ii	29
Gurnard, Little	70	ii	36
Gurnard, Mailed		ii	38
Gurnard, Malarmat	71	ii	38
Gurnard, Yellow		ii	173
Gurnard, Shining		ii	27
Gurnard, Streaked	67	ii	25
Gymnetrus arcticus		ii	246
Gymnetrus, Hawkins'		ii	251

H

	Plate.	Vol.	Page.
Haddock	136	iii	62

	Plate.	*Vol.*	*Page.*
Hagfish . . .		iv	408
Hairtail . . .	78	ii	61
Hake . . .	148	iii	99
Hake, Lesser . .		iii	128
Hake's Dame . .	153	iii	124
Halfbeak, Blunt-headed	208	iv	139
Halfbeak, European	208	iv	135
Haliou . . .		iv	141
Hammerhead . .	16	i	70
Harengus . . .		iv	79, 95
Hegemenus . .		ii	109
Hegetera . . .		ii	109
Hemiramphus Europœus		iv	135
obtusus . .		iv	135
Herling . . .		iv	209
Herring . . .	202	iv	78, 95
Herring, Fresh-water		iv	292
Herring, Leach's .		iv	107
Hexanchus griseus .		i	21
Hipper . . .		iv	245
Hippocampus . .	241	iv	364
brevirostris .		iv	364
Hippoglossus Limandoides		iii	153
vulgaris . .		iii	149
Hirundo Plinii . .		iv	128
Hoe . . .		i	49
Hoe, Mother . .		i	60
Holocentrus merou .		i	198
Hornbeak . . .		iv	149
Hound, Rough .	2	i	14
Hound, Smooth . .	10	i	47
Huso . . .	36	i	163

I

Ide	198	iv	63
Isurus oxyrhynchus .		i	41

J

Jack Ruff . .		i	193
Jago's Goldsinny .	153	iii	47
Julis vulgaris . .		iii	49
Jura Sucker . .		ii	196

K

King of Herrings		i	145
Kingston . .		i	73
Kite . .		iii	161

L

Labrax lupus . .		i	189
Labrus Cornubicus .		iii	43
coquus . .		iii	34
exoletus . .		iii	41
Julis . . .		iii	44
lineatus . .		iii	30

	Plate.	*Vol.*	*Page.*
Labrus luscus . .		iii	38
maculatus .		iii	24
mixtus . . .		iii	34
pusillus . .		iii	24
tinca . . .		iii	24
variegatus .		iii	34
Lacertus . . .		iv	141
Ladyfluke . .	159	iii	149
Lamia		i	25
Lamna Cornubica .		i	41
Lampern . . .	247	iv	395
Lampetra . . .		iv	385, 404
Lamprey, Sea . .		i	2
Lamprey, Sea . .	247	iv	385
Lamprey, Mud . .	248	iv	404
Lamprey, Planer's .	248	iv	402
Lamprey, Silver . .	247	iv	400
Lampris luna . .		ii	133
Lancelet . . .	248	iv	415
Lanthorn Gurnard .	70	ii	33
Latruuculus albus .		ii	172
Latus		ii	55
Launce, Larger .	157	iii	143
Launce, Lesser . .	157	iii	137
Launce, Short-snouted	158	iii	144
Launce, Wide-mouthed		iii	143
Lepadogaster biciliatus		ii	190
bimaculatus . .		ii	195, 198
cephalus . .		ii	201
Lusitanicus .		ii	59
Lepidopus argyreus .		ii	59
caudatus . .		ii	59
Lusitanicus . .		ii	59
tetradens . .		ii	59
Leptocephalus Morrisii		iv	348
Lepturus . .		ii	61
Leuciscus alburnus .		iv	53
cephalus . .		iv	44
cæruleus . .		iv	61
dobula . .		iv	51
erythrophthalmus		iv	49
Idus . . .		iv	63
Lancastriensis .		iv	59
Phoxinus . .		iv	64
rutilus . .		iv	47
vulgaris . .		iv	54
Lichia glaucus . .		ii	139
Ling . . .	145	ii	89
Lingula . . .	179	iii	161
Liparis Montagui .		ii	193
nostras . .		ii	190
reticulatus .		ii	195
vulgaris .		ii	190
Loach . . .	199	iv	69
Loach, Spined . .	199	iv	72
Lob . . .		iii	85
Lochleven Trout .	220	iv	242

	Plate.	*Vol.*	*Page.*
Long-finned Captain		ii	33
Longnose		iv	146
Lophius eurypterus		ii	213
Piscatorius		ii	204
Lopkins		ii	204
Lophotes		iii	175
Lota Gallorum		iii	93
molva		iii	89
vulgaris		iii	93
Lucius		iv	150
Luckyproach		ii	11
Lumpfish	105	ii	183
Lupus		i	189
Lupus Budegassa		ii	215
marinus		ii	242

M

	Plate.	*Vol.*	*Page.*
Mackarel	79	ii	65, 67
Mackarel, Dotted	81	ii	81
Mackarel, Garrick		ii	141
Mackarel Midge	151	iii	106, 113
Mackarel, Scribbled	81	ii	84
Mackarel, Spanish	80	ii	78
Maigre		ii	54
Malarmat		ii	39
Mary Sole		iii	167
Maurolicus Borealis		iv	301
Megrim	168	iii	177
Mendole	46	iii	206
Merlangus carbonarius		iii	84
Pollachùs		iii	80
virens		iii	87
vulgaris		iii	74
Merlucius vulgaris		iii	99
Miller's Thumb	59	ii	6
Minnis		i	167
Minnis		iv	64
Minnow	199	iv	64
Mœna vulgaris		i	206
Molva lota		iii	93
vulgaris		iii	89
Monkfish	17	i	73
Monochirus variegatus		iii	203
Montagu's Blenny	113	ii	231
Montagu's Sucker	107	ii	192
Morghi		i	14
Morrhua æglefinus		iii	62
callarias		iii	66
lusca		iii	70
minuta		iii	92
vulgaris		iii	53
Morris	238	iv	348
Motella Cimbria		iii	111
glauca		iii	111
mustela		iii	108
tricirrata		iii	105
Motella quinquecirrata		iii	108
vulgaris		iii	105
Mugil alatus		iv	125
auratus		iii	19
capito		iii	6
cephalus		iii	6
curtus		iii	17
octoradiatus		iii	20
Mullet, Golden		iii	19
Mullet, Grey	122	iii	6
Mullet, Eight-rayed		iii	20
Mullet, Lesser Grey	123	iii	15
Mullet, Long-finned		iii	19
Mullet, Long-finned	123*	iv	421
Mullet, Red	48	i	217
Mullet, Short		iii	17
Mulligranoc		ii	226
Mullus barbatus		i	217
imberbis		ii	25
ruber		i	217
surmuletus		i	209
Muræna	237	iv	335, 340
Musculus		ii	109
Mus		iv	370
Mustela barbata		iv	74
fluviatilis		iii	43
vivipara		ii	239
vivipara		iv	387
Mustelus lævis		i	47
vulgaris		i	47
Myliobatis		i	135
Myxinè		i	2
Myxinè		iv	408

N

	Plate.	*Vol.*	*Page.*
Nucrates ductor		ii	107
Nine Eyes		ii	236
Notidanus griseus		i	21
Numbfish		i	119
Nursehound	1	i	11

O

	Plate.	*Vol.*	*Page.*
Oldwife	49	i	222
Onos		iii	65
Opah	93	ii	133
Ophidion		iii	131
Ophidium barbatum		iii	131
Bearded	155	iii	131
Beardless	237	iv	333
Broussonetii		iv	333
Orcynus alalonga		ii	100
Orthagoriscus mola		iv	377
oblongus		iv	381
Osmerus Hebridicus		iv	297
Ostracion quadricornis		iv	366
Otterpike		ii	48
Oxeye		i	225

P

	Plate.	Vol.	Page.
Paganellus	99	ii	157
Pagellus centrodontus		i	237
erythrinus		i	233
Orbenii		i	235
Rondeletii		i	231
Pagrus		i	228
orphus		i	231
Palmer Trout		iv	245
Parr	221	iv	245
Passer asper		iii	185
fluviatilis		iii	195
Peal	212	iv	200
Pearl		i	161
Pelamid	85	ii	102
Pelamys		ii	192
sarda		ii	102
vera		iv	425
Perca cabrilla		i	195
cernua		i	193
channus		i	195
fluviatilis		i	185
gigas		i	198
labrax		i	89
robusta		i	198
Perch	39	i	185
Perch, Dusky	43	i	198
Peristedion malarmat		ii	38
Peristellus cataphractus		ii	38
Petromyzonidæ		iv	
marinus		iv	385
phoxinus		iv	64
Petromyzon fluviatilis		iv	395
branchialis		iv	404
Pholis levis		ii	226
Phrynorhombus unimaculatus		iii	173
Phycis blennoides		iii	125
furcatus		iii	125
Picked Dog	11	i	49
Pike	210	iv	150
Pilchard	201	iv	79, 96
Pilot-fish	87, 90	ii	107, 123
Pink		iv	64
Pipefishes		iv	350
Pipefish, Broad-nosed	239	iv	355
Pipefish, Greater	239	iv	351
Pipefish, Ocean	240	iv	356
Pipefish, Snake	241	iv	593
Pipefish, Straight	241	iv	363
Pipefish, Worm	241	iv	361
Piper	66	iv	23
Plaice	169	iii	181
Platessa elongata		iii	193
flesus		iii	195
limanda		iii	185

	Plate.	Vol.	Page.
Platessa limandoides		iii	153
platessa		iii	181
pola		iii	90
vulgaris		iii	181
Pleuronectidæ		iii	146
Pleuronectes arnoglossus		iii	177
cyclops		iii	161
cynoglossus		iii	190
flesus		iii	195
elongatus		iii	193
hippoglossus		iii	149
hirtus		iii	170
limanda		iii	185
limandoides		iii	153
mangillii		iii	203
maximus		iii	155
megastoma		iii	167
punctatus		iii	170
rhombus		iii	161
solea		iii	200
variegatus		iii	203
Poggè	72	ii	41
Pole	173	iii	190
Pollack	142	iii	80
Pollack, Green	144	iii	87
Pollack, Rauning		iii	84
Pollack, Sey		iii	88
Pollan	231	iv	292
Polyprion cernium		i	200
Polyprosopus macer		i	68
rashleianus		i	68
Pomeranian Bream	189	iv	42
Pompilus	90	ii	107
Pope		i	193
Porbeagle	8	i	41
Poutassou	141	iii	77
Powan	232	iv	295
Power	139	iii	72
Picklefish		i	167
Pristiurus melanostomus		i	18
Pterocephala		i	139
Pterycombus		ii	131
Pugtrout		iv	211
Pungitius		i	167
Puppyfish		i	73

Q

	Plate.	Vol.	Page.
Queen		iii	187
Queen Sole		iii	167

R

	Plate.	Vol.	Page.
Rabbitfish		i	145
Rabblefish		i	85
Raia acus		i	93
batis		i	87
circularis		i	115
clavata		i	99
Fabreriana		i	139
intermedia		i	95

	Plate.	Vol.	Page.
Raia maculata		i	104
marginata		i	110
microcellata		i	107
miraletus		i	104, 112
mucosa		i	105
mucronata		i	93
radiata		i	103
rostellata		i	110
Rainbow Wrass	134	iii	49
Rana piscatrix, R. marina		ii	204
Raniceps jago		iii	122
trifurcatus		iii	122
Rauning Pollack	143	iii	84
Ray		i	2, 47, 86
Ray, Bordered	26	i	110
Ray, Cramp		i	119
Ray, Cuckoo	27	i	112
Ray, Eagle	32	i	135, 138
Ray, Electric		i	119
Ray, French		i	117
Ray, Horned		i	139
Ray, Ox	33	i	139
Ray, Painted	25	i	107
Ray, Sandy	28	i	115
Ray, Shagreen	29	i	117
Ray, Shark		i	73
Ray, Sharp-nosed		i	97
Ray, Small-eyed		i	107
Ray, Spotted	24	i	104
Ray, Starry	23	i	103
Ray's Bream	92	ii	129
Red Eye		iv	49
Red Bandfish	120	ii	262
Red Snakefish		ii	262
Regalicus Banksii		ii	251
Remora	88	ii	113
Rhombus arculeatus		iii	155
arnoglossus		iii	177
cardina		iii	175
hirtus		iii	170
levis		iii	161
maximus		iii	155
megastoma		iii	167
non aculeatus		iii	161
norvegicus		iii	175
punctatus		iii	170
vulgaris		iii	161
Ribband Fishes		ii	245
River Bullhead		ii	6
Roach	191	iv	47
Roach, Blue		iv	61, 76
Rock Cook	130	iii	41
Rock Goby	98	ii	153
Rockling, Three-bearded	149	iii	105
Rockling, Four-bearded	150	iii	111
Rockling, Five-bearded	150	iii	108
Rough or Row Hound		i	14
Rough Flapper		i	117
Rubellus		iv	47
Rudd	192	iv	49
Ruff	41	i	193
Rutilus		iv	47
latior		iv	49

S

	Plate.	Vol.	Page.
Sailfish		i	60
Sailfish, Fluke	163	iii	163
Salmo albellus		iv	200
albus		iv	219
cæcifer		iv	243
Cambricus		iv	243
fario		iv	225
ferox		iv	222
gracilis		iv	216
salar		iv	163
salmulus		iv	245
trutta (see page 200)		iv	214
Salmon	211	iv	163
Salmon, Silver		iv	208
Salmon, Slender	216	iv	216
Salmon Trout	215	iv	214
Salvelini		iv	
Samlet (young of Salmon)	221	iv	245
Sandnecker		iii	153
Sapphirine Gurnard		ii	21
Sardine		iv	112
Saury	208	iv	141
Scabbard-fish	77	ii	58
Scad	94	ii	136
Scaldfish		iii	177
Scalefoot		ii	59
Sciæna	76	ii	54
Sciæna	76*	iv	423
Sciæna aquila		ii	54
aquila		iv	423
cirrhosa		ii	50
umbra		ii	54
umbra		iv	423
Scomber		ii	67
bisus		ii	105
colias		ii	78
glaucus		ii	139
maculatus		ii	78
Pelamis		ii	97
Pelamitus		ii	102
punctatus		ii	81
scriptus		ii	86
Thynnus		ii	85
trachurus		ii	136
vulgaris		ii	67

	Plate.	Vol.	Page.
Scomberesox Camperii		iv	141
saurus		iv	141
Scopelus Pennantii		iv	301
Scorpæna Bellonii		ii	8
Norvegica		ii	3
Scurf		iv	200
Scyllium catulus		i	60
melanostomum		i	18
stellaris		i	11
Scymnus		i	54
Scymnus borealis		i	57
Sea Adder		i	180
Sea Adder, Greater		iv	351
Sea Ape		i	37, 145
Sea Bream		i	220
Sea Eagle		i	135
Sea Fox		i	37
Sea Snail	106	ii	190
Sea Trout (Truff)	214	iv	211
Sea Wife		iii	37
Sebaster Norvegicus	135	ii	3, 157
Selache		i	60
Serranus cabrilla		i	195
gigas		i	198
Norvegicus		ii	3
Sewen	213	iv	208
Sey Pollack		iii	88
Shad, Allis	204	iv	117
Shad, Scale-finned	206	iv	123
Shad, Twait	205	iv	122
Shadefish		ii	51, 54
Shanny	113	ii	216
Sharks		i	2, 10, 79, 86
Shark, Basking	14	i	60
Shark, Blue	6	i	28, 66
Shark, Greenland	13	i	57
Shark, Grey		i	21
Shark, Rashleigh	15	i	67
Shark Ray		i	72
Shark, Six-gilled	4	i	21
Shark, Spinous	12	i	54
Shark, Sunfish		i	60
Shark, White	5	i	25
Sharpling		i	167
Sheatfish	200	iv	74
Shot		iv	225
Shude		iv	41
Silurus glanis		iv	74
Silver-spots		iv	300
Simia marina		i	145
Skate	18	i	87
Skate, Burton	21	i	97
Skate, Flapper	20	i	93
Skate, Friar		i	97
Skate, Long-nosed	19	i	93
Skate, Mavis		i	97
Skate, White		i	97
Skipper (Scopster)		iv	141
Skulpin, Dusky	104	ii	178
Skulpin, Golden	103	ii	172
Skulpin, Yellow	103	ii	172
Smear Dab	161, 162	iii	187
Smelt	227	iv	276
Smelt, Hebridal	233	iv	297
Smelt, Sand	121	iii	1
Soldier		ii	19
Sole	176	iii	200
Sole, Bastard		iii	201
Sole, Lemon	178	iii	205
Sole, Red-backed		iii	203
Sole, Sandy		iii	205
Sole, Thickback	177	iii	203
Sole, Variegated	177	iii	203
Solea		iii	199
Solea aurantiaca		iii	208
Pegusa		iii	205
variegata		iii	203
vulgaris		iii	200
Sparoids		i	220
Sparus aurata		i	243
cantharus		i	222
centronotus		i	237
dentex		i	203
four-toothed		i	203
mæna		i	206
Spinachia vulgaris		i	180
Spinax		i	49
Sprat	203	iv	109
Sprat, Great-headed		iv	124
Spurdog		i	49
Squalus acanthias		i	49
borealis		i	57
canicula		i	11
carcharias		i	25
catulus		i	45
Cornubicus		i	41
galeus		i	45
griseus		i	21
maximus		i	60
mustelus		i	47
Rashleighanus		i	67
spinax		i	49
spinosus		i	54
squatina		i	73
vulpes		i	37
Squatina angelus		i	73
vulgaris		i	73
Sticklebacks	37	ii	167
	38	ii	180
Stingbull		ii	43
Stingfish		ii	8
Sting Ray	31	i	130
Stone Bass	44	i	200

	Plate.	Vol.	Page.
Sturgeons		i	150
Sucker, Connemara	109	ii	201
Sucker, Doubly-spotted	108	ii	198
Sucker, Jura		ii	196
Sucker, Lump	105	ii	183
Sucker, Network	107	ii	195
Suckingfish		ii	113, 181, 196
Sunfish, Short	245	iv	377
Sunfish, Longer	246	iv	381
Sunfish Shark		i	69
Surmullet	47	i	209
Surmullet, Red		i	217
Swordfish	97	ii	145
Swordick		ii	236
Syngnathus acus		iv	351
Typhle		iv	355
lumbriciformis		iv	361
ophidion		iv	359
hippocampus		iv	364

T

	Plate.	Vol.	Page.
Tadpolefish		iii	122
Tench	183	iv	22
Tetradon mola		iv	377
Pennantii		iv	373
Thickback		iii	203
Thompson's Midge	155	iii	119
Thornback Ray	22	i	99
Thrasher	7	i	37
Thrasher		ii	147
Thryssa		iv	117
Thynnus brachypterus		iv	425
Pelamis		ii	97
thynnus		ii	86
vulgaris		ii	86
Tiburo		i	25
Tinca vulgaris		iv	22
Tinker	37	i	176
Toadfish		i	135
Toadfish		ii	204
Tobianus		iii	140
Toper	9	i	46, 53
Topknot, Bloch's	166	i	173
Topknot, Eckstrom's	167	i	175
Topknot, Muller's	165	i	170
Torgoch	223	iv	264
Torpedo	30	i	119, 127
Torsk	147	iii	96
Trachinus draco		ii	43
major		ii	43
vipera		ii	48
Trachurus vulgaris		ii	136
Trachypterus arcticus		ii	246
Trichiurus lepturus		ii	61
Trigla adriatica		ii	25

	Plate.	Vol.	Page.
Tringa aspera		ii	36
cataphracta		ii	38
cuculus		ii	19
hirundo		ii	21
lineata		ii	25
lucerna		ii	33
lyra		ii	23
obscura		ii	33
pæciloptera		ii	36
Trotter		iv	245
Trout	218	iv	225
Trout, Grey		iv	214
Trout, Lake	217	iv	221
Trumpetfish	124	iii	21
Trunkfish, Four-horned	242	iv	367
Trutta fluviatilis		iv	225
salmonata		iv	200
Trygon		i	130
Tubfish	65	ii	21
Tunny	82	ii	86
Tunny, Long-finned		ii	100
Tunny, Short-finned	82*	iv	425
Turpæna		i	119
Turbot	161	iii	155
Tusk		iii	96
Twait Shad	205	iv	122
Typhlè	239	iv	355

U

	Plate.	Vol.	Page.
Umbrina	75	ii	50
cirrhosa		ii	50
vulgaris		ii	50

V

	Plate.	Vol.	Page.
Vaagmar	118	ii	246
Vandellius lusitanicus		ii	59
Vendace	230	iv	289
Viviparous Blenny	116	iv	239
Vulpecula		i	37
Vulpes		i	37

W

	Plate.	Vol.	Page.
Weever, Greater	73	ii	43
Weever, Viper	74	ii	48
Wels		iii	74
Whales		i	61
Whiff		iii	167
Whitebait	203	iv	114
Whiting	140	iii	74
Whiting, Pollack		iii	80
Whitling		iv	219
Wolf-fish	117	ii	242
Wrass, Baillon's	132	iii	45
Wrass, Ballan	125	iii	24

	Plate.	Vol.	Page.
Wrass, Comber . .	126	iii	32
Wrass, Cook . .	127	iii	31
Wrass, Green . .	126	iii	30
Wrass, Rainbow .	134	iii	49
Wrass, Scale-rayed	129	iii	38
Wrass, Small-mouthed		iii	41
Wrass, Striped .		iii	34
Wrass, Three-Spotted	128	iii	36

X

	Plate.	Vol.	Page.
Xiphias gladius .		ii	145
Xiphotheca tetradens .		ii	59

Y

	Plate.	Vol.	Page.
Yarrell's Blenny .	114	ii	233
Yellow Gurnard . .		ii	173

Z

	Plate.	Vol.	Page.
Zeugopterus velivolans		iii	163
Zeus faber . . .		ii	118
aper . . .		ii	142
luna . . .		ii	133
Zoarces viviparus .		ii	236
Zoarchus . . .		ii	239
Zygæna malleus .		i	70

FINIS.

B. FAWCETT, ENGRAVER AND PRINTER, DRIFFIELD.

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 00719 8476